The Chemical Age

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A New Chemical By-Product

BECAUSE there is proverbially nothing new under the sun, the term "new" must be subject to qualification. The account that is published in other pages of the paper contributed to the Institute of Fuel on "Liquefied Fuel Gas" recounts endeavours to introduce a chemical by-product that is new to this country but has been in existence as an article of commerce on the other side of the Atlantic for over thirty years. "Liquefied fuel gas," consisting for the most part of mixtures of propane, *n*-butane and isobutane, according to its origin, is supplied in containers under a pressure of about 30 lb. per sq. in. It is derived from natural gas or refinery gases by scrubbing with oil; or from the hydrogenation of coal, as a by-product. The product marketed in this country is known as Calor gas, and is primarily derived from the hydrogenation plant at Billingham. The cost is some three or four times that of coal gas, and therefore its uses are specialised and limited.

Calor gas is useful for all purposes for which coal gas can be used, but because of its cost is confined to places where coal gas—and presumably electricity—are not available. There are some 500,000 houses in this country that have no gas supply and not much prospect of getting one. How large these houses are is not known, but it may be taken as certain that the large country houses will for the most part have their own generating plants, and some have even their own gas-works, microscopic in size, but requiring only the part-time services of one man to look after them. The great majority of the unprovided houses must be cottages, and these may range from the isolated crofter's or shepherd's hut to groups forming small villages. The small villages in so highly developed a country as Great Britain will sooner or later be provided with a supply of gas or electricity. In any event, no normal family inhabiting one of these small houses can possibly afford to pay between 2s. and 2s. 6d. a therm for fuel and light, when paraffin oil can be so cheaply obtained and coal (admittedly less efficient) can be delivered at between 1d. and 4d. per therm according to the district.

It was, we believe, Dr. E. F. Armstrong who uttered a warning a few months ago against the increasing tendency to emphasise salesmanship at the expense of technical methods of production. This, however, is the directly opposite case. Here is a by-product that is produced willy-nilly and that can be recovered without great expense, research or technical skill; the difficulty is to sell it and unless uses can be found for it, oil refineries and hydrogenation plants will lose a by-product that might be of considerable value to them. From the analysis here given it may be suggested that two primary lines of development should be pursued. The first is better organisation of distribution, possibly through the oil companies and the gas companies working in co-operation, whereby the cost to the consumer can be materially reduced. The second development is work to discover new uses for these liquified gases which shall be independent of the isolated country house market. One such use—dependent upon a reduction of price—is for the enrichment of blue water gas in gas-works, and we cannot doubt that imaginative investigation will reveal others.

This discussion would savour of much ado about nothing were it not for the possibly large quantities of propane-butane gas that may be available in the future. These gases might, given a market, be recovered from low temperature carbonisation plants; although the critical summary of the Institute of Fuel discussion that we gave in these columns recently did not seem favourable to the further development of hydrogenation, it cannot be denied that there may be considerable extensions of the Billingham plant and that through by-products of this character the balance sheet might be considerably improved. If it be decided to store crude oil against times of emergency, the possibility is that there would be a great increase in the numbers and capacity of refinery and cracking plants operating in this country, so that propane-butane gases would be derived from this source.

Finally, Sir John Cadman, in his presidential address to the Institution of Petroleum Technologists, has declared that whilst only drilling can give a definitive result, the indications obtained by experienced petroleum geologists are such as to warrant deep drilling for oil in this country in zones previously unexplored (permian, lower cretaceous and jurassic rocks). If petroleum were to be discovered in important quantities, the disposal of the gases and their constituents would immediately constitute an important problem in the utilisation of the country's resources. Propane and butane are not amongst the most reactive of substances, but we suggest in all seriousness that chemists in general should take note of the raw material that is now available and that may become available in huge quantities, and should consider whether there is any application that these gases would have in their industries. It has been suggested publicly that petroleum chemists can polymerise as easily as they can crack. If all else fails, this "liquefied fuel gas" might be made the raw material for polymerisation.

Notes and Comments

More Dyestuffs from Germany

THE decrease of £152,536 in the value of British chemical exports in January compared with the corresponding month of 1935 was followed in February by a small increase of £3,669 over February, 1935, leaving a decrease (with adjustments) for the two months of £148,867. Imports in January were £105,048 above the 1935 figure; in February they were £44,258 higher than last year, giving a (corrected) total increase for the two months of £146,839. (In the Board of Trade returns corrections for past periods are carried to the aggregate totals which are therefore not always equal to the sum of past periodic figures as published.) The large decrease in exports is mainly accounted for by the fact that shipments to Italy have fallen from £34,619 to £662; Japan from £100,440 to £52,103; Germany from £74,504 to £42,215; China from £103,543 to £70,032 and the United States from £158,532 to £130,653. Japan reduced her imports of British sulphate of ammonia from £18,281 to £1,003 (for the first two months of 1934 she took £38,366 worth). The United States bought only £46,121 worth of coal tar products from Great Britain in January and February, compared with £94,473. South Africa took only £8,555 worth of disinfectants and insecticides, against £19,966, although the total exports of chemical products to South Africa at £280,287 showed an increase of £5,704. More than a third of the entire increase in imports is accounted for by the single item of dyes and dyestuffs from Germany (£133,770 in 1936, compared with £83,901 in 1935). We also imported £76,845 worth of dyestuffs from Switzerland, against £68,875 last year. Despite the continued operation of import duties, more dyestuffs to the value of £60,421 were imported in the two months than in the same period of last year.

A Storehouse of Chemicals

THE Dead Sea was described as one of the most striking phenomena on the globe by Mr. M. A. Novomeysky at the annual meeting of the Institution of Chemical Engineers in London on March 6. His paper was the prelude to a discussion on one of the world's richest sources of chemicals. With its average level some 1,300 ft. below the Mediterranean Sea level, and with a depth of another 1,300 ft., the Dead Sea is the lowest point on the world's land surface. It fills part of a great rift in the earth's surface and it represents a great natural reservoir without any outlet. From the River Jordan and from the Judean Hills by way of subterranean springs the Dead Sea receives 8,800,000 cu. metres of water every day, and its only method of discharge to make way for such a huge intake is by evaporation. During the past hundred years there have been expeditions to the shores of the Dead Sea from England, America, France and Germany. These investigations have revealed how the evaporation of the waters has left behind a vast storehouse of chemicals. Salts of potash and magnesium and calcium are brought into the sea by the waters of the Jordan, and bromine comes in from the hot springs of Herod's Bath that have been known from Roman times. Although the sea is only about 47 miles long with a width of nine miles, it is estimated that it contains some 40,000,000,000 metric tons of valuable salts in solution. One of the most valuable, although in lesser quantities than others, is muriate of potash, of which more than 2,000,000,000 tons are thought to be present. The recovery of these valuable salts is developing to a substantial industry in Palestine, 25,000 to 30,000 tons of potash now being produced annually, with scope for expansion to 100,000 tons a year. More than 1,000 tons of bromine are being produced annually at present. Only one raw material needs to be imported, and that is fuel oil.

Organisation for Defence

STATEMENTS have been made in the course of the debate upon the defence problem in the House of Commons which give an incorrect picture of the attitude of the Federation of British Industries. The Federation has limited its action to offering to be of any service to the Government, should its assistance be needed, in assuring that the defence programme will be carried out with the maximum of efficiency and at a reasonable cost. The grand council has placed on record that " it is the desire of British industry to cooperate to the full with the Government in any steps that may be necessary to make good the deficiencies in the defence forces of the Crown." It is the considered opinion of the Federation that the industries of the country should be taken into the confidence of the Government and charged with the task of themselves setting up any organisation required to meet Government needs and of ensuring that the work is carried out on a reasonable basis of cost which shall be fair both to industry and to the Government. A small committee, composed of the president and three immediate past presidents of the Federation, has been appointed to keep in close consultation with the Government.

Accidents in Industry

THE high rate of accidents among young people engaged in industry will be one of the outstanding subjects of discussion at the National Industrial Safety Conference, organised by the National Safety First Association, to be held at Balliol College, Oxford, on April 3. The opening address will be given by Mr. D. R. Wilson, Chief Inspector of Factories, who will speak on " Accidents and the Young Worker." Interest will be added to the discussion by reason of the fact that industry safety committees have been giving special consideration to the question of the young worker. Other conference speakers will include Mr. J. V. Peacock, of the London Brick Co. and Forders, on " Electrical Hazards in Industry"; Mr. R. D. Tugman, of Imperial Chemical Industries, Ltd., on " Goggles, Masks, and Protective Devices for the Head"; and Mr. W. H. Garrett, of Monsanto Chemicals, Ltd., on " The Place of the Foreman in the Safety Organisation."

IMPORTS of glycerine into the United States, entered for consumption, both crude and refined, declined in 1935, according to preliminary figures. Incoming shipments of crude glycerine in 1935 totalled 8,220,934 lb. ($656,734) compared with 15,081,227 ($1,040,065) in 1934.

Polymerisation of Drying Oils

Some Current Theories

A TENDENCY to put forward theories on very slender experimental grounds with regard to the polymerisation of drying oils was criticised by Professor T. P. Hilditch, D.Sc., in a discussion held by the Manchester Section of the Oil and Colour Chemists Association on February 14, Dr. V. G. Jolly, F.I.C., presiding.

Although great difficulties are encountered in such work, said Professor Hilditch, it seems that only ultimate chemical studies will lead to a fuller understanding of the problem, and single measurements, *e.g.*, refractive index, viscosity or iodine value, cannot lead very far. He referred to the published work of Steger and van Loon, and also of Waterman, on the distillation of polymerised oils in the molecular still; the less polymerised part of the oil contains a higher proportion of saturated acids than the rest. Far too little attention is paid to the actual glyceride structures of particular oils, many of which have been fully investigated in recent years. Linseed oil, for example, is not a mixture of triolein, trilinolein, and trilinolenin, but is a far more complex mixture of triglycerides and contains saturated acids, so that its structure cannot be calculated from the iodine value.

By way of initiating the discussion, the work of Rossmann (1933) was mentioned. On heating elæostearic ester there is a tendency to form monomeric derivatives containing a cyclohexadiene ring, and also to form dimeric polymers containing a many-membered ring. What chemical evidence is there of the existence of these rings? It is comparatively simple to prove the point of oxidation. Another possibility has been suggested by Kappelmeier, who supposes a union of two molecules with rearrangement of a double bond and the formation of a cyclohexene derivative.

Coming next to linseed oil, Wolff and Rabinowicz have suggested that linoleic and linolenic radicles on heating undergo a change with the formation of conjugated double bonds, and polymerisation then proceeds. They isolated a solid isomeric form of linoleic acid and showed that this absorbed iodine in amount corresponding to one double bond, agreeing with the presence of a conjugated system.

Air Drying of Paint Film

Passing on to the question of air drying of the paint film, we can take it on the basis of the work of G. W. Ellis (1926) and the very definite contribution to the subject made by Morrell and Marks (1931) that in the early stages atmospheric oxidation may be represented like this:—

$$\begin{array}{c}\mathrm{-CH}\\ \| \\ \mathrm{-CH}\end{array} + \mathrm{O_2} \longrightarrow \begin{array}{c}\mathrm{-CH}\\ | \\ \mathrm{-CH}\end{array}\ \mathrm{O_2} \longrightarrow \begin{array}{c}\mathrm{-C.OH}\\ \| \\ \mathrm{-C.OH}\end{array} \text{ or } \begin{array}{c}\mathrm{-CO}\\ | \\ \mathrm{-CH.(OH)}\end{array}$$

The unstable peroxide rearranges into the keto alcohol or enclic type. Scheiber has suggested that when an oil film dries an intermediate group is first oxidised thus:—

$$\mathrm{-CH=CH-CH_2-CH=CH-} \text{ to } \mathrm{-CH=CH-CO-CH=CH-}$$

It seems to have been well established that one double bound accounts for one molecule of oxygen during the drying of an oil. The first stage appears to have been definitely established, but what happens next in order to give a film is not quite clear.

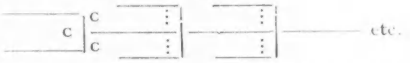
Professor Hilditch said that having been rather outspoken about the tendency to theorise rather than apply experimental study to the work he would indicate a few possibilities in order to obtain the view of the meeting. It is possible that by a simple rearrangement one could get:—

$$\begin{array}{c}\mathrm{-CO}\\ | \\ \mathrm{-CH.OH}\end{array} + \begin{array}{c}\mathrm{CH-}\\ \| \\ \mathrm{CH-}\end{array} \longrightarrow \begin{array}{ccc}\mathrm{-CH} & \mathrm{-O-} & \mathrm{CH-}\\ | & & | \\ \mathrm{-CO} & & \mathrm{CH_2}\end{array}$$

or by the interaction of two oxidised radicles:—

$$\begin{array}{c}\mathrm{-CH.OH}\\ | \\ \mathrm{-CO}\end{array} + \begin{array}{c}\mathrm{-CO}\\ | \\ \mathrm{-CH.H}\end{array} \longrightarrow \begin{array}{cc}\mathrm{-C.OH} & \mathrm{-C.OH-}\\ | & | \\ \mathrm{-CH.OH} & \mathrm{CO}\end{array}$$

Dr. Malkin, said Professor Hilditch, has published the results of X-ray analysis of fatty oils, definite triglycerides and solid fats and concludes that the general form of the triglyceride molecule in the solid state is as shown. Polymerisation may take place in the manner indicated by the dotted lines, to produce complex molecules:—



Dr. WALKER expressed appreciation of Professor Hilditch's opening remarks, and agreed that a great deal of theory has been built up on slender foundations. Much of the work on oil polymerisation has been on technological rather than scientific lines, but more recently the problem has been tackled scientifically. The work of Steger and van Loon is particularly interesting and has shown that a heat-treated oil contains a monomeric material different in structure from that present before heat treatment. This may be the result either of two unsaturated chains joining together to give dimeric acid without alteration of the glyceride molecular weight or the chains may curl round and form rings. In both cases the drying properties seem to be wasted.

A Bad Start Historically

Dr. ALLAN suggested that the investigation of the problem has had a bad start historically. In the case of the carbohydrates the simpler members of the group were first tackled and the cellulose structure then attacked from a very sure foundation. With linseed oil we have tried to go the other way. Morrell and Marks recognised this and by concentrating on a simple substance gained much important information. The linseed oil question is undoubtedly very difficult and every modern method, chemical and physical, including X-ray analysis, should be brought to bear on it.

Dr. SLEIGHTHOLME arrived at the conclusion that there was no very satisfactory theory of polymerisation, leading directly to further work. At the same time, it seems likely that we have to bear in mind two distinct types of polymerisation, carbon to carbon linkage (effect of heat alone) and linkage through oxygen (air drying). These two types may be present together, as in the drying of stand oil or the preparation of stand oil in the presence of air. The catalytic effect of oxygen in heat polymerisation is well known and may be due to activation of units which form chains in a manner similar to that suggested by H. S. Taylor (1931) and by Staudinger (1931). Light also catalyses the drying of films of oil and it would be interesting to know if any work had been done on the combined effect of heat and light. With regard to the waste of drying power mentioned by Dr. Walker, it is a fact that stand oil dries more slowly than raw oil, but the resulting film is more durable probably due to the lower proportion of hydroxyl and other groups containing oxygen.

Dr. HILL maintained that we ought to go back to simpler systems and referred to some work carried out in America on the polymerisation of acetylene, which, under controlled conditions, yields divinyl acetylene:—

$$3\,\mathrm{CH \equiv CH} \longrightarrow \mathrm{CH_2 = CH.C \equiv C.CH = CH_2}$$

The grouping here resembles the triply conjugated system responsible for the drying properties of tung oil. Divinyl acetylene in thin films behaves like a drying oil and becomes hard and insoluble. The polymerisation of the simpler vinyl compounds has been studied by Staudinger, who showed that in a system $CH_2:CH.X$ (where X is a negative group) polymerisation occurs through the primary valencies thus:—

$$\mathrm{CH_2 = CHX} \longrightarrow \ldots \mathrm{CH_2} - \overset{\mathrm{X}}{\overset{|}{\mathrm{CH}}} - \mathrm{CH_2} - \overset{\mathrm{X}}{\overset{|}{\mathrm{CH}}} - \mathrm{CH_2} - \overset{\mathrm{X}}{\overset{|}{\mathrm{CH}}} - - -$$

Divinyl acetylene polymerises in this way, but cross-linking

also takes place owing to the presence of two vinyl groups, giving hardness and insolubility. Professor Hilditch mentioned Wolff's view that shifting of double bonds occurred on heating linseed oil. Recently Kino, in Japan, polymerised methyl linoleate at 290° C. and concluded that no displacement of the double bonds took place.

Mr. McQuillen expressed relief that primary bonds had come once more into favour, as it is not long since we were told that everything was explained in terms of association and that if a polymerised oil were extracted long enough with acetone all would dissolve. He actually tested this and found that there was a limit to the amount which would dissolve. All the evidence points to a carbon-carbon linkage and it is well known that a stand oil film is more durable and elastic than a raw oil film. He was afraid he did not agree with Dr. Sleightholme that a stand oil film was slower drying.

Are Stand Oil Films Slow Drying ?

Dr. Sleightholme suggested that Mr. McQuillen should test this point by applying films of raw and stand oils to a glass plate, without using driers. He had forgotten to mention a point which should not be overlooked : the one double bond of oleic acid has no drying properties at all, these are present in linoleic and linolenic acids, therefore it is reasonable to suppose that the additional double bond has an activating effect. Morrell and Marks found that only two molecules of oxygen were taken up by each elæostearic radicle. Some so-called colloidal theories of oil polymerisation appear to be merely more complicated methods of describing the changes taking place and lead nowhere.

Dr. Jolly said the matter seems to be divided into two distinct channels, polymerisation without oxygen, and polymerisation preceded by oxidation. These are connected and it would be interesting to know if any work has been done on polymerisation in the absence of all oxygen. We might possibly link up the results of Steger and van Loon, who obtained more saturated acids in their distillate, with work on the distribution of these acids in the original glycerides.

Dr. Myles pointed out that by submitting polymerised linseed oil to high vacuum distillation we remove about 40 per cent., which contains 70 per cent. of the saturated acids present in the oil. The iodine values of both the distillate and the residue are about the same (130-135) and the polymerised oil also has an iodine value of 130-135. Starting with the iodine value of the original oil (180-185), it is possible to say that the value 130-135 agrees with the formation of a dimeric substance from an oil containing 6-7 double bonds per molecule, using one double bond for each molecule reacting. At this stage the iodine value remains more or less steady and the residue shows a molecular weight about 3,500. There seems to be some evidence from Long's work that the dimeric molecule is prone to aggregation.

Undue Reliance on Iodine Value

Professor Hilditch then pointed out that too much reliance must not be placed on the I.V. of 130 for both distillate and residue. The saturated acids in the original linseed oil amount to about 10 per cent., of which 7 will be in the 40 per cent. of distillate, which therefore contains 17½ per cent. saturated acids. There can only be 3 left in the 70 per cent. residue, which only contains, therefore, 5 per cent. of saturated acids. The chemistry of fats as a whole had a bad start historically and for many years the academic chemist seemed to lose interest. The matter cannot be simplified too far as triolein, for example, will not dry, it is necessary to have at least two double bonds. Dr. Walker has not said what chemical evidence there is of cyclisation during stand oil formation.

Dr. Myles suggested that there was a fallacy somewhere. The I.V. measurements were done by a standard method, but are probably not a true measure of the unsaturation. The relatively high I.V. of the distillate seems to point to the presence of highly unsaturated material in it, which has not undergone polymerisation.

Dr. Walker regarded the equality of iodine values of the residue and distillate as a coincidence. Steger and van Loon fractionated polymerised linoleic and linolenic esters and found that the monomeric fractions were not ordinary unsaturated material.

Mr. Robinson stated that Steger and van Loon polymerised the pure ethyl esters of linolenic and linoeic acids for 15 hours at 290°-300°. The unchanged portion is very small and from another fraction a monomeric acid $C_{18}H_{34}O_2$ was obtained by hydrogenation. They could not identify this fraction and concluded it had a cyclic structure. They are working on the right lines by taking the simple ester in the pure state, and we should tackle the problem in the same way.

Dr. Allan, commenting upon Mr. Robinson's statement that Steger and van Loon polymerised at the usual temperature of 290-300°, pointed out that polymerisation occurs both above and below this range.

Mr. McQuillen pointed out that polymerisation at 270° for a long time gave an oil soluble in acetone and the iodine value dropped from 180 to 140 ; at 290° an insoluble fraction developed.

Professor Hilditch, in concluding the discussion, said it had been a pleasure to come and that he hoped that it was felt that the discussion had been interesting as he himself had found it so. It was quite evident considerable work was being carried out on the heat polymerisation of oils.

Mining Royalties and Rents

An Authoritative Guide to Law and Custom

The amount and method of assessment of royalties are regarded as matters of considerable importance in the development and prosperity of a mining industry. The extent of these royalty charges may be illustrated by the fact that coal in Great Britain pays nearly £5,000,000 per annum ; in the Federated Malay States tin pays nearly £1,000,000, whereas in the Union of South Africa the profits tax, excess profits duty, etc., on the gold industry produced over £13,000,000 per annum in 1934-5.

In view of the recent announcement of the British Government's intentions in regard to the unification of coal-mining royalties, it is particularly opportune that the Mineral Resources Department of the Imperial Institute should now issue an up-to-date and authoritative work on "Mining Royalties and Rents in the British Empire" (3s. 6d. net), a work in the compilation of which it has had the co-operation of over 70 members of overseas mining departments and some hundreds of companies working mineral deposits in the United Kingdom.

Following an introduction dealing briefly with royalty systems in general, the main subject matter is divided into two parts. In Part 1 (132 pp.) the statement for each country opens with a summary as regards the ownership and right to work minerals (whether vested in the Government or in private persons). Next follow details of royalties and export duties leviable on minerals and metals, and the period, terms of renewal and "dead" or sub-surface rents of mining leases. In Part 2 (29 pp.) the royalties and export duties detailed in Part 1 have been summarised for reference purposes, under eight groups, *i.e.*, coal, petroleum and natural gas, bituminous and oil shales, ores of iron and of the ferro-alloy metals, base metals, precious metals, precious stones, and miscellaneous minerals.

A glance through the document shows that royalties levied on certain minerals (*e.g.*, coal) are roughly uniform in many parts of the Empire, but in the case of other minerals (*e.g.*, gold) wide divergence occurs, both as regards the amount and basis of the charge. Some countries assist the small producer by reducing the rate of royalty on small mineral outputs or profits, and others encourage the working of low-grade deposits in a similar manner. In view of the increasing interest in India's industrial possibilities, the details concerning royalties imposed both in British India and in eighteen Native States will doubtless prove useful.

X-Ray Crystal Analysis and Organic Chemistry

Dr. J. D. Bernal Delivers the 33rd Bedson Lecture

IT is only in the last five years that the use of the methods of crystal structure analysis have begun to make positive contributions to organic chemistry, said Dr. J. D. Bernal, delivering the 33rd Bedson Lecture at Newcastle-on-Tyne, on February 21.

X-ray methods had already been used with astonishing success in solving the problem of the structure of silicates and of alloys. In organic chemistry, however, purely chemical methods of determining the structure of molecules had gone very much further than in the other fields, and consequently the early X-ray work of Sir William Bragg's school was mostly concerned in verifying the physical basis of the molecular formulæ already deduced by organic chemists. This situation is now changed in two directions. In the first place the methods of crystal analysis can be used rapidly and effectively to determine the approximate molecule structure of a compound of unknown structural formula, particularly if there are available a number of closely related substances. This may be called the extensive method of crystal analysis and has been used with considerable success in the unravelling of the structure of the vitamins and hormones.

Internal Symmetry

On the other hand, the more refined methods of X-ray analysis have now, particularly in the hands of R. M. Robertson and his co-workers, been used to determine not only the atomic, but even the electronic structure of molecules with an accuracy greater than a chemical method could provide. Thus, even where we know the chemical formula we have a means for finding further details about the nature of the bonds and the internal symmetry of the molecule. This may be called the intensive method of analysis.

X-ray analysis of crystals is formally analogous with the use of a high power microscope able to see the atoms themselves. Seeing with X-rays, however, is a somewhat indirect process. It is not only that we cannot see X-rays, but we cannot for lack of lenses photograph the image of the crystal made by X-rays. What we can do is effectively to put the photographic plate in the focal plane of the lenses, photograph the diffracted spectra of the object and then construct the image by mathematical analysis. This analysis, however, does contain a serious ambiguity in that we observe only the intensity but not the phase of the diffracted beams, and the great difficulties of intensive analysis are all concerned with getting over this ambiguity.

Luckily, however, a great deal can be found out before we get to this stage. The ordinary X-ray photograph of a crystal is the surest means of identification. The coincidence of a 100 spots in position and intensity is a far greater justification of identity than two single melting point observations, and this identity can be established on extremely small amounts. It is possible in ordinary X-ray apparatus to photograph a crystal of one-millionth of one milligramme weight and micro apparatus can handle crystals a thousand times smaller.

The Unit Cell of the Crystal

At the next stage the measurement of the unit cell of the crystal gives far the most accurate method we have yet found for determining molecular weight. With length measurement accurate to one part in three thousand, and density to one in a thousand, a molecular weight accurate to one in five hundred can be obtained, and with good crystals ten times this accuracy would not be impossible. This may mean in practice that the organic chemical methods could be reversed and a rough chemical analysis fitted on to an exact molecular weight determination. Further, we can, by the use of an auxiliary pyro-electric and piezo-electric method, determine the symmetry of the molecules, and at the same time in doubtful cases decide the question as to whether we are dealing with a simple substance, a molecular compound, or a polymer.

The next stage, however, is the most important. By a combination of optical methods and simple observation of X-ray intensities it is possible in many, but not all, cases to determine the rough shape and size of the molecules themselves. This is particularly valuable when dealing with unknown natural products because even when it is not decisive it enables a large number of possible formulæ to be eliminated at sight. Taken in conjunction with chemical work in preparing derivatives and break-down products it may shorten the time taken to discover the true formula by a very large factor, and absolutely prevent the maintenance of incorrect formulæ. In favourable cases it is possible to go further than this and to determine by differential method the positions of substituted groups in the molecule, particularly where it is possible to mark a part of the molecule with a heavy constituent, such as the bromine or iodine atom.

Intensive Crystal Analysis

For deeper knowledge of molecular structure it is necessary, however, to proceed by the more laborious method of intensive crystal analysis. The method has the disadvantage that it is only applicable to certain cases, but this disadvantage may be turned by choosing a derivative of the substance to which the method is applicable. Here the extensive and intensive methods of analysis work together. It is by extensive means that those crystaline substances likely to give satisfactory complete analyses are picked out of a large number of related compounds.

In general, the approach to a complete analysis is indirect. Some kind of model has first to be constructed and in turn used as a basis for the more precise Fourier analysis. But this is not a circular movement. A wrong initial model will lead to an impossible molecular picture, the work may have to be done all over again, but there is no possibility of serious error. In the preliminary stages, experience of other structures is an invaluable guide and consequently the skilled crystal analyst requires both his long training and as great a flair for his subject as the research chemist. To a certain extent this has been modified by the new method of absolute Fourier analysis introduced by Patterson, where a fair idea of the structure can be obtained in a straightforward way. Once this preliminary stage is over the procedure is one of computation of a somewhat exhausting nature, but where semi-mechanical and ultimately entirely mechanical methods can be used, the latter only being held up for lack of funds. As a result of this work we obtain a two-dimensional picture of the molecule, taken in any direction that is found convenient.

Inter-Atomic Distances

From this picture it is possible to measure directly, and to an accuracy of about 1 per cent., inter-atomic distances and the angles between the bonds, and in this way get an exact map of the chemical molecule and one which has considerably modified our ideas of chemical forces. Thus between the double bond of length, 1.37 Å, and the single bond, 1.54 Å we find a number of intermediate bond lengths covering the whole range, and even in the case of oxalic acid a single bond of length, 1.58 Å. More than this, when we get the distribution of electrons in the molecule, we can distinguish at sight such atoms as N, O or C.

The final stage of structural analysis has already been reached by R. M. Robertson, where without any assumptions he has been able to make a full projection of a complex

organic molecule showing the positions and nature of all its atoms, and thus has furnished the first independent proof of the physical reality of the structural formulæ of the organic chemist.

The methods of X-ray analysis, concluded Dr. Bernal, must plainly play an increasing part in modern organic chemistry, not only in research but in routine operations. Only conservativeness prevents it from being to-day the standard method in every chemical laboratory. Just as no laboratory can be without its balance, microscope and its spectroscope, so it should not be without a simple X-ray camera. X-ray methods are, from the technical point of view, more exact than chemical methods. Different grades of the material may have very different technical qualities while indistinguishable to chemical and microscopic analysis, but they immediately reveal their differences to the X-ray method.

Wherever new synthetic substances are being prepared, or new natural substances are being extracted, the X-ray method should be used. The particular value of the X-ray method will, however, show most clearly on the attack on their complicated substances for which ordinary chemical methods are difficult to apply, as, for instance, in the chemistry of proteins and other polymerised substances. There is no question, however, of making X-ray analysis a substitute for chemical analysis; rather there must be a close collaboration of the two methods.

Economics of Production

An Address to the Andersonian Chemical Society

THE economics of production was the subject of an address which Dr. Thomas Ewan, M.Sc., F.I.C., recently delivered to the Andersonian Chemical Society, at the Royal Technical College, Glasgow.

The quantity of goods available, said Dr. Ewan, is rarely limited by the quantity of matter in the earth (radium and platinum are possibly examples of such a limitation); the limit is usually the quantity of labour available. There is always one consumer per head of population, but there is always less than one possible producer. For example, in Great Britain the distribution of population is: Age up to 15, 28 per cent. being educated; 15 to 60, 63 per cent. possible producers; over 60, 9 per cent.

Where the efficiency of producers is low an effort is always made to increase their number by pressing children and the aged into the ranks. An increase in the quantity of goods available per head is, therefore, only attainable by increasing the efficiency of each producer, that is, the quantity of goods which he can produce per year. The efficiency of each new generation increases automatically, because it inherits material things made by its predecessors, for example, roads, harbours, buildings and cultivated lands; more important still is the heritage of knowledge about the material universe. It should be clear that a person is not likely to handle matter and energy efficiently if he is ignorant of their nature—and all production involves the handling of living and dead matter and some form of energy. Education is, therefore, of primary importance.

The labour required to produce anything is the aim of that needed to make the tools and that needed to operate them. A machine, therefore, does not necessarily save labour, but it is easy to calculate in each special case whether it does so or not. The mechanical work which a man can do is small; a very strong man can work at the rate of 1.5 h.p. for two to three seconds, at 0.25 h.p. for two to three hours, and at 0.12 h.p. for eight to ten hours. The human machine is, therefore, most effective when used as an intelligent relay to control other machines.

The abundance and accessibility of matter in the earth is a third factor of importance. For example, the labour expended in producing a ton of metal is nearly proportional to the number of tons of ore which must be handled, the nature of the metal is of relatively minor importance. The production costs of iron, copper and gold are roughly £3, £25 and £107,000 per ton, and the tonnages of mineral which must be worked up are 3 to 4, 20 to 25 and 128,000 respectively. In agriculture the labour used in cultivating one acre is the same whether the resulting crop is large or small. The labour per ton of produce is inversely proportional to the size of crop. If population increases, less favourable soils and climates must be brought into use until ultimately expansion is stopped by the yield obtained being too small to sustain life. Unlimited expansion of population must ultimately lead to a fringe living at the subsistence limit, however much the technique of production is improved.

It is frequently stated that we are living in a world superabundantly supplied with goods and that the poverty of most human beings is due to some unknown fault in the system of distribution. If this is true an increase of productive efficiency is unnecessary. Evidence of superabundance will be most readily obtained in a rich country like Great Britain; if it cannot be found here it is not likely to be found elsewhere. The total income of the inhabitants of Great Britain is about £3,000 million per year: if equally divided each person would have £66 per year. This amount is sufficient to maintain life, but it is universally agreed that £66 per year will not buy everything that a reasonable person wants. If it is assumed that an income of £300 per head would be satisfactory, at the existing level of prices, then every available producer would have to be employed producing from £500 to £600 worth of goods yearly. Statistics for a few of the larger industries are available, and it it safe to assume that the amount of labour employed is the least which will produce the output of the industry: the value of goods produced divided by the total number of persons employed is therefore the maximum efficiency of a producer using existing methods.

The average individual spends 80 per cent. of his income on the bare necessaries of life, compared with 50 per cent. for the comfortable family, concluded Dr. Ewan.

Society of Chemical Industry

Newcastle Section Annual Meeting

THE annual meeting of the Newcastle Section of the Society of Chemical Industry was held on March 10 under the presidency of the retiring chairman, Mr. M. P. Appleby, of Billingham. The election of officers resulted as follows: Chairman, Mr. J. W. Craggs; vice-chairman, Professor H. L. Riley; hon. treasurer, Mr. B. P. Hill; hon. secretary, Mr. Ernest M. Myers. Mr. M. P. Appleby was elected the Section's representative on the North-East Industrial Development Board.

During the evening there was an interesting exhibition of chemical apparatus on view, including insulating materials, magnesia and zinc oxide in various applications, Pyrex glass and chemical glassware, vitreosil, synthetic resins, etc.

The new chairman has for many years acted as hon. secretary of the Section and also acted as secretary of the committee which made the special report in north-east industries. Mr. Myers is well known in the coke oven industry, having been a president of the C.O.M.A. He is now in charge of the coal sales department of the Charlaw and Sacriston Coal Co., Ltd.

Applications of Metal in Chemical Engineering—III

By H. W. CREMER, M.Sc., F.I.C., M.I.Chem.E.

Extracts from an Address delivered before the London Section of the Institute of Metals on February 6.
(Continued from page 239)

UNDOUBTEDLY one of the chief factors in the choice of constructional materials for use in connection with high pressure work is the effect of the hydrogen used so frequently as one of the reactants. The generally used engineering steels such as nickel-chromium, nickel-chromium-molybdenum, chromium-vanadium, chromium-molbdenum steel, etc., have greatly superior resistance to mild steel.[4] In the properly heat-treated condition, the limiting temperature causing attack of these steels at 250 atmospheres is between 300° and 350° C. The effect of variations in the structure throughout any one tube or vessel must be appreciated. A light sealing weld, for instance, may alter the structural condition of the steel in the immediate neighbourhood of the weld to such an extent that attack will occur there under conditions which do not cause attack of the remainder of the steel. It is necessary, therefore, to heat-treat such parts after welding.

It will be realised, of course, that where possible the chemical engineer endeavours to design his plant so that the actual reaction vessel does not itself have to withstand the mechanical stress due to pressure, and to separate it from the pressure resisting walls by a layer of heat insulating material. The inner vessel therefore withstands the temperature and not the pressure, the outer wall the pressure and not the temperature. In his book "The Design and Construction of High Pressure Chemical Plant,"[5] H. Tongue deals in considerable detail with the materials and type of construction used for a wide range of high pressure equipment.

Properties at Low Temperatures

The mechanical properties of metals at low temperatures have not been studied so extensively as those in higher ranges. This is not surprising in view of the much more common use of heat than intense cold. Occasions do arise, however, when it may be necessary to subject some substance to a high pressure whilst maintaining it at a very low temperature. Some interesting results from the Research Department of Imperial Chemical Industries (Alkali), Ltd., at Northwich, were published in 1933, on the properties of some austenitic stainless steels[6] and non-ferrous metals[7] at low temperatures. These steels, apart from their excellent corrosion resistance, were shown to have mechanical properties at very low temperatures which would be very attractive to the engineer. As regards the non-ferrous metals, although it is difficult to generalise on the large number of results reported, it would appear evident that the copper-nickel alloys tested, 70-30 brass, nickel-silver, and a copper-aluminium-nickel alloy, with their excellent properties throughout the range 20° C. to −180° C., will prove valuable materials for plant to work at temperatures below zero.

Qualities of Monel Metal

It will be clear, even from the bare outline given, that the chemical engineer is a very exacting person where some of his constructional materials are concerned, demanding materials of construction with reliable properties over a wide range of temperature, involving good retention of strength and ductility up to, say, 500° C., and retention of ductility down to the temperature of liquid air. It does not follow, of course, that any one material is called upon to serve over this whole range, but Monel metal and certain alloy steels of the 18/8 class afford very striking figures as to what can be expected of some constructional materials between these wide limits of temperature. The following figures may be quoted in this connection:—

	−180°C.	Room temp.	500°C.
Monel (Hot rolled)			
Tensile strength, tons/sq. in.	60.5	40.8	31.0
Yield point, tons/sq. in.	31.6	19.7	—
Elongation % on 2 in.	53.5	45.7	35.0
Staybrite 18/8.			
Tensile strength, tons/sq. in.	99.5	41.4	30.5
Yield point, tons sq/in.	33.3	16.5	13.2
Elongation % on 2 in.	45.7	54.0	49.0

In the ordinary way, if the strength of an alloy is increased by heat treatment by quenching above the critical range, by age hardening, or by cold working, whilst the tensile strength can be raised very considerably, a loss in ductility results. One thought comes to an outside observer like myself, *viz.*, can very much more be expected from alloying *per se*, or must we look in some other direction for an increase in the strength of metals and their alloys? Complicated alloys or processing of metals is of comparatively little use unless the original casting, forging, etc., is sound, and it may be truthfully said that a sound casting is better than much alloying.

Tensile Strength

It is a well known fact that the tensile strength of a crystal like that of common salt is much smaller than the value calculated by means of the lattice theory from electrostatic forces. For example:—

	Tons per sq. in.
Sodium Chloride Crystal.	
Theoretical strength	131
Actual strength	0.315
Iron.	
Theoretical strength	1,900
Actual strength	19

This great discrepancy between experimental and theoretical values is ascribed chiefly to the "notch effect," which may arise from the presence of incidental small cracks on the surface, but which is due especially to the more or less regularly distributed defects of the crystal (*Lockerstellen*). In particular, the investigations of Smekal and his co-workers have shown how many properties of crystalline matter are dependent upon these internal defects of the crystal structure. A general discussion held by the Faraday Society last September was devoted in part to this subject. It is one which is receiving considerable attention at certain research centres, and one which it is perhaps not out of place to mention at this point. One cannot refrain from speculating upon the possibilities which may eventually be realised as a result of freeing metals from gases and other non-metallic impurities by vacuum melting, for instance, followed by subjection to ultra-pressures during or immediately following casting with a view to forcing the material to arrange itself more perfectly.

Developments in the Use of Metals and Alloys

The lecturer at this point made a brief survey of the more recent developments in the use of metals and alloys as they affect chemical engineering. This survey, which dealt in particular with the non-ferrous metals, included also the high silicon irons, the heat-resisting cast irons, the chromium and nickel irons and the alloy steels. Reference was also made to the employment of metallic coatings as protective media and to the use of metals as catalysts.

In conclusion, some very brief observations might be made on that very important matter "Co-operation."

[4] The Effect on Various Steels of Hydrogen at High Pressures and Temperatures. N. P. Inglis and W. Andrews. "J. Iron & Steel Institute," No. II; for 1933.

[5] Chapman and Hall, 1934.

[6] The Mechanical Properties of Some Austenitic Stainless Steels at Low Temperatures. E. W. Colbeck, W. E. MacGillivray and W. R. D. Manning, "Trans. Inst. Chem. Eng.," 1933, *11*, 89.

[7] The Mechanical Properties of Metals at Low Temperatures, Pt. II, Non-Ferrous Metals, E. W. Colbeck and W. E. MacGillivray, "Trans. Inst. Chem. Eng.," 1933, *11*, 107.

In Utopia, which is described as a social state of ideal perfection, the design, choice of materials, fabrication and erection of a chemical plant would doubtless be carried out by the chemist, the chemical engineer and the process metallurgist working in the closest collaboration. Unhappily, there is frequently a lack of co-operation and certainly a lack of understanding, which sometimes leads to failure in the finished plant and to the disappointment of all concerned. It will be generally agreed that far too much secrecy on either side still exists. The supplier is often asked to suggest materials without specific details being given by the user as to the conditions which these materials are required to withstand. Such cases are becoming less frequent, but there is still much misguided secrecy in relation to chemical and other processes which is quite inexcusable. Some suppliers are not guiltless in this respect, however, and still refuse to disclose analyses of their products.

It is, of course, possible, though perhaps expensive, to have analyses made, but to the discerning analyses alone are sometimes sufficient guide to the suitability or otherwise of a material, and much irritation may be caused if such information is withheld.

Again, the marketing of a new constructional material is unfortunately too often accompanied by exaggerated claims as to its suitability, and even to-day the chemical engineer is not infrequently offered the perfect corrosion-resisting material without any reference to the concentration or temperature of any particular corrosive agent. These things tend to result in disappointment to the user and in many cases to the condemnation of something which was in all probability excellent for use in its proper sphere. It is highly desirable, therefore, that the properties of a new material should be thoroughly well known before it is generally marketed, by which properties are meant such normal physical characteristics as machinability, weldability, effect of cold work, etc., on resistance to corrosion, the effect of surface finish, and the forms in which the alloy is available.

To specialists in metals this contribution may appear to be discursive rather than informative, but it will not have been written entirely in vain if it catalyses, even in a small measure, the freer and fuller co-operation between those two classes of individual who already have so much in common, the metallurgist and the chemical engineer, not only in their endeavours to be of assistance to one another, but what is of still greater importance, in helping to conserve the rapidly diminishing metallic resources of the world.

Liquefied Fuel Gas

Future Use Anticipated in England

A MEETING of the Institute of Fuel was held in London on February 26, when Mr. H. Pickering, of the Calor Gas Co., read a paper on liquefied fuel gas, and predicted its general use in this country at an early date. Mr. E. G. Stewart, of the Gas Light and Coke Co., presided.

The sources of liquefied gas, said Mr. Pickering, fall under three heads: (*a*) natural gas, (*b*) refinery gas, and (*c*) coal hydrogenation. Preparation from natural gas has grown up by the side of the manufacture of natural petrol. It started in the United States in 1903, with a process for the compression of natural gas to extract the lighter ends of petrol to mix with the heavy and not very valuable fractions of naphtha obtained from the distillation units.

Scrubbing Natural Gas

The modern process most in favour is that of oil scrubbing. The natural gas is scrubbed with a rather heavy oil in bubble cap towers under pressure; the pressure is then reduced, resulting in the separation of most of the methane and ethane. The remaining liquid products are then passed through a preheater into a steam-heated still where the oil is stripped and returned to the absorbing tower while the vapours go into a water-cooled condenser and suffer partial condensation. The condensate is composed principally of butane and higher hydrocarbons. The uncondensed vapours are then compressed to 75 lb. per sq. in. gauge and again condensed. A third stage of compression to 275 lb. per sq. in. and condensation is operated and leaves the uncondensed gases essentially methane and ethane. The composition of the condensates is somewhat as follows:—

	1st Condensate. Per cent.	2nd Condensate. Per cent.	3rd Condensate. Per cent.
Methane and ethane ..	10	10	20
Propane	20	30	30
Butane	50	45	40
Higher hydrocarbons ..	20	15	10

These condensates are mixed and in another still, or stills, the heavier fractions are cut from the bottom, the methane and ethane from the top, and in some cases the propane and butanes are separated.

The separation of propane and the butanes from refinery gases does not differ in principle from their separation from natural gas, but under this heading may be mentioned the production of liquefied gases from the products of the numerous cracking processes. By reason of its nature the cracking processes give gases which are unsaturated rather than saturated, and about 50 per cent. of the gas obtained from cracking processes is olefinic in character.

The process for the hydrogenation of coal by the Imperial Chemical Industries at their Billingham factory produces, as by-products, all the saturated hydrocarbon gases such as methane, ethane, propane and normal and iso-butane.

Method of Distribution

In the home of the industry, America, liquefied gas in bulk is distributed by rail, road and river in pressure tanks and also in the more usual type of cylinder container. In this country butane is distributed in small cylinders each of which contains 28 lb. of liquid butane. The tare weight of these cylinders is about 21 lb., so they are in an exceedingly convenient form to handle. They are sent out with a considerable free space in them to take up the thermal expansion of the liquid: this free space amounts to about 20 per cent. of the total volume of the cylinder.

As a source of light and heat, liquefied gas has the advantage that there is a high calorific capacity in a small volume. One pound of liquid butane, occupying 48 cu. in., will vaporise to about 6.6 cu. ft. of gas at atmospheric temperature and pressure, and give 21,340 B.Th.U. gross on combustion. It has, therefore, the high calorific value per unit volume of a liquid fuel while dispensing with any special vaporising equipment, although it is true that for very high rates of discharge—over 20 cu. ft. per hour for long periods and at low temperatures—it may be advisable to use two cylinders in parallel so that the latent heat of vaporisation may not lower the temperature of the liquid gas to such an extent that vaporisation ceases. Such cases, however, are not often met in domestic practice.

Compared with other compressed gaseous fuels the low ratio of the container weight to the calorific capacity is most striking in the case of butane. One bottle of butane with a gross weight of 49 lb. contains approximately 600,000 B.Th.U. equivalent to 12,150 B.Th.U. per lb. gross weight. This is made possible by the lightweight cylinders which may

be used to retain the small pressure of about 30 lb. per sq. in. gauge which is necessary at ordinary temperatures for maintaining the contents in liquid form. This same low pressure in the cylinder makes it safe and easy for unskilled hands to use.

Compared with coal gas, butane has a much higher available heat per cu. ft. of gas, and a rather higher available heat per cu. ft. of gas-air combustion mixture, as the following figures show :—

	B.T.U. per cub. ft.			
	At 500° C.		At 1,000° C.	
	Pure gas.	Gas-air.	Pure gas.	Gas-air.
Butane	2,450	76.5	1,000	31.2
Coal gas 435 B.T.U.'s net	340	61.8	140	25.4

This factor leads to rather higher thermal efficiencies when using butane than when using coal gas : the measured increase ranges from 3 per cent. to 6 per cent. The flame temperature of butane can be calculated to be 2,080° C. and has been measured at 1,900° C.

Industrial Uses of Liquefied Gas

Liquefied gas may be used to form a community service to domestic consumers by transporting it in bulk from the place where it is manufactured and then vaporising at a central plant for distribution. In this service it is usually mixed at the vaporising plant with the primary air it requires before distribution, a procedure that is perfectly safe because the explosion limits of butane are narrow and low. For small villages where the higher capital cost of a gas-producing plant cannot be justified, this process has economic possibilities. Butane can also be used in place of cracked gas to enrich water gas where this is normally made to meet fluctuating loads, and in this sense its constant heat value and easy operation make it very convenient to handle.

Although the flame temperature of butane is only 1,900° C. this does not preclude its use for cutting and brazing metals and alloys of low melting point such as brass and bronze, the welding of aluminium and lead burning. In fact, the lower flame temperature is in some ways a positive advantage, as it prevents the burning of the work in unskilled hands and produces sharper edges.

Liquefied gases can be distributed in many various manners and receptacles—cylinders range in size from a contents capacity of 5 lb. to 100 lb., and tanks range from 500 lb. to 10,000 lb. capacity. In this country the small receptacle is at present in favour, but for certain types of industrial work the large tank is preferable : such tanks can be mounted on either road or rail chassis. The uses made of liquefied gases are many, but to-day their development in the British Isles has not been extensive. For a number of years butane-propane mixtures have been in use in a small way for some industrial plants, and of quite recent date the Calor Gas (Distributing) Co., Ltd., has developed domestic use of butane for cooking, heating and lighting in rural communities not serviced by gas mains.

A Demonstration of Equipment

On the Continent butane is distributed in containers of 13 kilo capacity through a distribution chain of high-speed lorries of approximately 500 containers per lorry, direct to retail distributors such as ironmongers, hardware stores, etc., and thence to the consumers. In America containers of 100 lb. capacity are in general use. Two such containers are supplied to a consumer and connected together with a dual connection in which is inserted a two-way tap so that when one container is exhausted a turn of the tap puts the full container into service.

At the conclusion of the paper, Mr. Pickering demonstrated the use of Calor gas in various forms. There was a gas fire burning 2.6 c. ft. of gas per hour ; a small laboratory Bunsen consuming 0.25 c. ft. per hour ; a hot plate with two burners consuming 1.5 c. ft. per hour, a gas iron, and a lighting bracket with twin mantles giving 120 candle-power with a consumption of 0.55 to 0.88 c. ft. per hour. All this apparatus was connected to one cylinder. It was also mentioned that a cylinder of Calor gas which had cost 15s. to fill had been in use on a small yacht for five weeks, supplying two cabin lights and a cooking stove, and that at the end of that period there was still some gas remaining in the cylinder. It was added that it was necessary to buy the original cylinder and a governor and the piping and fittings.

Points from the Discussion

THE CHAIRMAN, in opening the discussion, said there were still 500,000 homes which were for the moment outside the range of ordinary gas supply because they were in positions where it was unprofitable to run gas mains. It seemed to him that there were two problems in connection with Calor gas which had a considerable bearing on its ability to compete with the already established fuels. The first was with regard to the difficulties with apparatus, which were an engineer's job and should be overcome. Then there was the question of distribution. In some places the supply was being undertaken by the gas companies and, on the face of it, it would probably appear that there was nobody more fitted to take over the distribution, but it was easy to advance arguments why the gas companies should be the last people to touch it. In other countries local ironmongers were distributing this gas in containers and it might be asked why the local authorities should not do it. The petrol companies, with their vast distributing organisations, might undertake it, In a number of cases in which gas companies had taken up this distribution he had heard that their early enthusiasm had been damped by a succession of disappointments in connection with the apparatus, with the deliveries of butane and more recently with deliveries of the necessary consuming apparatus.

Butane or Propane?

The first time he was introduced to Calor gas was in a farmhouse many miles from any town on Long Island, New York, In that case it was not butane but propane gas that was being used, and he was interested in the manner in which the apparatus was installed, with change-over valves, so that when one cylinder was exhausted another was put on. There was also a supply of business-reply postcards which were sent off when new cylinders were required and these came along automatically. He had been wondering why butane was used in this country instead of propane. Possibly it was due to the fact that propane in this country was mostly produced by Imperial Chemical Industries, Ltd., and there was not sufficient to go round. In America there were small villages of eight or 10 houses supplied from what might be called model gasworks, from which butane mixed with air was sent out. Had the Calor Gas Co. any such project in mind for this country?

MR. W. H. CADMAN, remarking that the great value of this gas for rural districts could not be disputed, drew attention to the fact that this gas was free from CO and added that there were few gas companies in this country which did not use water gas in which there was a high percentage of CO. He wondered whether the gases obtained from low temperature carbonisation could be used for this purpose, as he believed these gases contained considerable percentages of butane and propane.

MR. HIRD asked if there had been any experience of compressing the gases from low temperature carbonisation, and remarking that there were traces of hydrogen he suggested it would be necessary to remove them before compression.

MR. PICKERING said he had had very little experience of compressing these gases.

DR. G. E. FOXWELL said that the gases from the hydrogenation of coal were almost entirely hydrogen; there was only about 10 per cent. of propane.

THE CHAIRMAN said the important point was that butane would liquefy under very low pressure, whereas it was neces-

sary to go to thousands of pounds pressure with the other gases in order to get the same energy in Calor gas.

Mr. PICKERING said that butane would liquefy at about 30 lb. pressure. In answer to further questions, he said that butane in the liquid form does not come under the Petroleum Regulations.

Mr. J. M. E. W. WEBBER asked if any precautions were taken with Calor gas to prevent the high pressure getting to the appliances if the governor failed: it was usual to do this in the case of coal gas.

Mr. PICKERING said no such precautions were taken, the assumption being that the regulator was perfect. He admitted, however, there had been trouble with regulators, due to the influence of the human factor, and agreed it would be advisable to take precaution against a failure of the governor.

THE CHAIRMAN asked whether consideration had been given to the possibility of delivering liquid butane to the local gas company for distribution in containers.

Mr. PICKERING said that was a possibility and a proposition of that kind was under consideration.

Pintsch Gas

Mr. J. KEWLEY said that every gallon of petrol sold at the present time contained butane, and there was an excess which the oil companies would be only too pleased to dispose of. In California probably millions of tons were wasted every year because it was not usable. On the other hand, propane was definitely used as a motor fuel in America, but there were difficulties in this connection with butane because the ordinary carburretor could not deal with it.

Mr. N. RABINOVITCH asked what difference there was between Calor gas and Pintsch gas, which was at one time used so largely for the lighting of trains. Pintsch gas was nothing but compressed gases obtained in the gasworks and the great advantage was the presence of the olefinic compound. Whether there were disadvantages he did not know.

Mr. PICKERING said that Pintsch gas was obtained by cracking gas oil and it contained a great deal of unsaturated hydrocarbons. To keep it in liquid form required higher pressure than in the case of butane. Pintsch gas was used for lighting buoys and the use of Calor gas for this purpose had also been gone into. One of the difficulties, however, was spontaneous lighting up and shutting off the light, but he believed that had been practically overcome. Moreover, Pintsch gas was much more expensive than Calor gas.

Mr. JOHN ROBERTS suggested that here was an opportunity for the coal industry, the gas industry and the oil industry to collaborate. Although this was a product of the hydrogenation process, it was also being made at the oil refineries at Llandarcy, and the oil companies should collaborate in the distribution through their petrol distribution organisation. Moreover, the oil companies could collaborate with the gas industry by supplying this fuel to the industry and render it unnecessary to make water gas to assist peak loads. He urged that this gas was a departure which all fuel economists should encourage.

A Special Type of Mantle

Dr. G. E. FOXWELL said it seemed to him that the attempt had been made to put this fuel on the market before its time. He could confirm what the chairman had said as to the disappointment of certain gas engineers who had taken it up, and he also personally complained of the strong stench attaching to the gas. With regard to lighting, he said he understood a special type of mantle was required and he inquired whether it was more expensive than the ordinary mantle. Further, what was the cost to the householder of a therm of this gas. The fuel was expensive compared with other fuels, but as far as he could see from the paper no particular advantage was claimed for it.

Mr. PICKERING replied that the ordinary silk mantle made by Welsbach was used for lighting with Calor gas. As to the stench, the gas from the hydrogenation of coal was odourless and a small addition was made to it to make it smell. The gas obtained from oil refineries had an odour and therefore was not treated in any way. It was wrong to suggest that this work had been started too early or too hurriedly. Everything had been properly arranged but great difficulties had been encountered with the appliance manufacturers. Cookers and appliances had been on order for months but deliveries could not be obtained. In the same way there had been considerable delays in getting manufacturers to alter existing appliances to use Calor gas. He believed the most effective method of distribution of the gas would be through the gas companies because they had staffs of competent fitters. For instance, special joints had to be used because ordinary graphite greases absorbed a great quantity of butane and eventually became spongy and leaked or dissolved. These difficulties had been overcome but there was the need for competent men to deal with the fittings.

A Comparison of Prices

As to the price per therm, the gas in the bottles was approximately 600 B.Th.U. and the retail price of the filling of the bottle was 15s., so that the cost to the consumer would be about 2s. 5d. per therm. At the same time, owing to the slow rate of combustion and the greater density of Calor gas, it could not be compared on an equal basis with coal gas. As an instance, the fire which was being demonstrated was burning approximately 2.6 c. ft. per hour, and as the calorific value of the gas as burned was about 3,250 B.Th.U., the total was about 8,450 c. ft. Assuming one of the five radiants in the gas fire would burn 4 c. ft. of coal gas per hour with a 500 B.Th.U. gas, that meant a total of 10,000 B.Th.U., as against 8,450 B.Th.U., with Calor gas, and the efficiency would be the same.

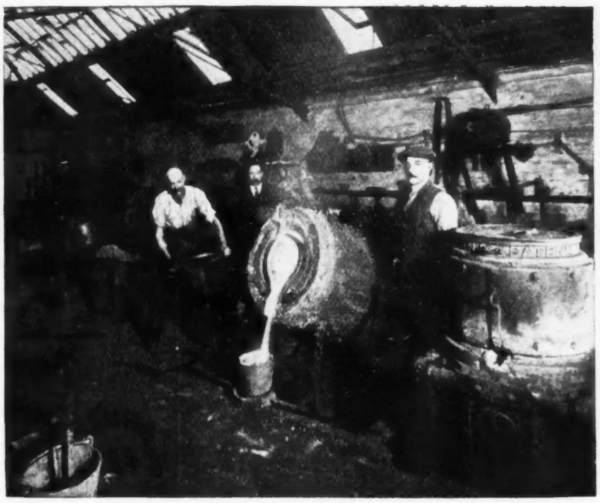
Dr. FOXWELL, referring to the figure of 2s. 5d. per therm for Calor gas, said that if allowance was made for some extra efficiency the cost might be reduced to 2s. 2d. or 2s. 3d. per therm. In connection with cost comparisons, he said he had heard recently of a gas undertaking which had to give a supply to a village 15 or 20 miles from the gasworks. There were very few houses and not a great deal of gas was used. What the engineer had done was to erect a small holder in the village and this was filled by means of compressed gas taken from the works. The cost worked out at between 1s. 3d. and 1s. 6d. per therm, so it appeared that the gas company could compete with Calor gas even for supply to isolated houses.

Cylinder Strength

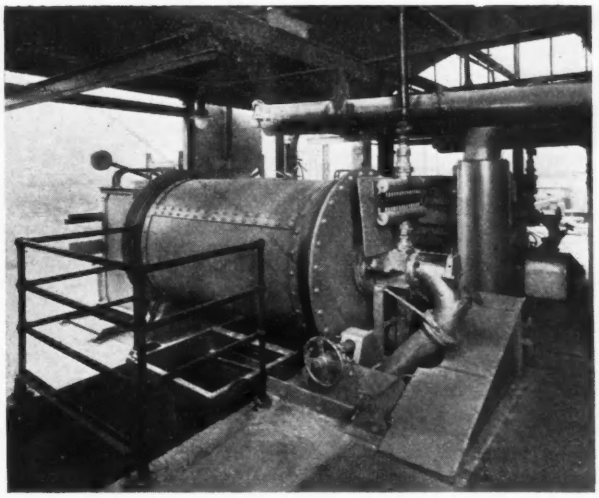
Mr. F. HORN asked whether the use of light alloys such as aluminium had been considered for the containers. Remarking on the fact that in the production of the gas there was a washing with caustic soda, he asked if there would be any caustic soda in the final product, as this would attack the metal.

Mr. PICKERING said there was no caustic soda in the final product. As to the containers, originally the Home Office insisted that they should have a thickness of 5 mm., but as the result of National Physical Laboratory tests, a thickness of 2 mm. was regarded as satisfactory by the Home Office. The containers at present being made, however, had a thickness of 2½ mm. and would withstand a pressure of 700 lb. per square inch.

GERMAN production and sales of alcohol increased considerably during the business year ended September 30, 1935, owing to increased consumption by the beverage, medicinal, cosmetic, and perfumery industries, and as motor fuel. Production of alcohol for all purposes totalled 3,727,500 hectolitres during the year, compared with 3,583,300 during the preceding fiscal period, and sales, as reported by the Reich Alcohol Monopoly, increased from 3,614,400 to 3,863,900 hectolitres. Stocks held by the monopoly were reduced about 10 per cent. during the year.



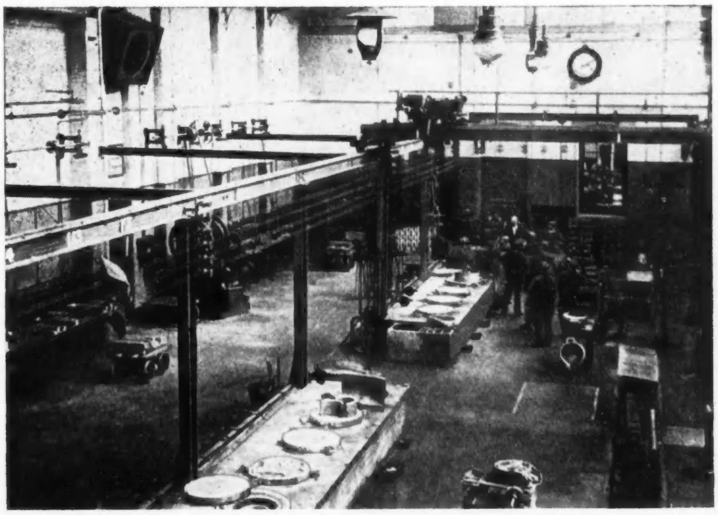
This installation of tilting furnaces for melting Admiralty metal has been converted from coke to gas firing. The gas consumption, at 3 lb. per sq. in. with fan air at 21 in. W.G., is less than 3,000 B.Th.U. per lb. of metal.



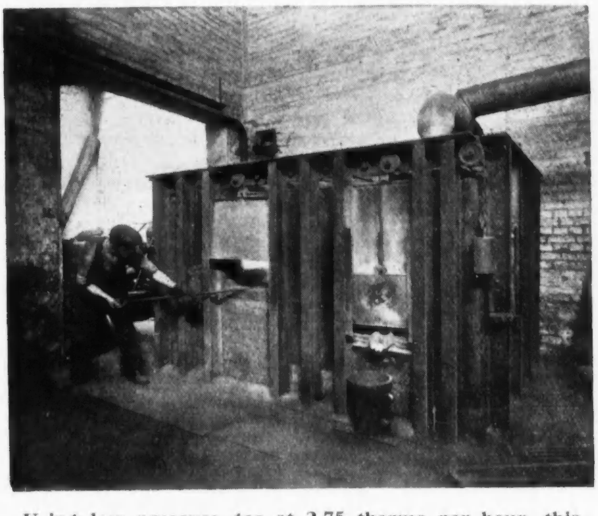
This gas-fired enamel frit-melting furnace, 500 lb. capacity, uses low pressure gas and fan air at 8 in. W.G., 4,500 B.Th.U. being needed to melt 1 lb. of frit.

Gas in Metallurgical Operations

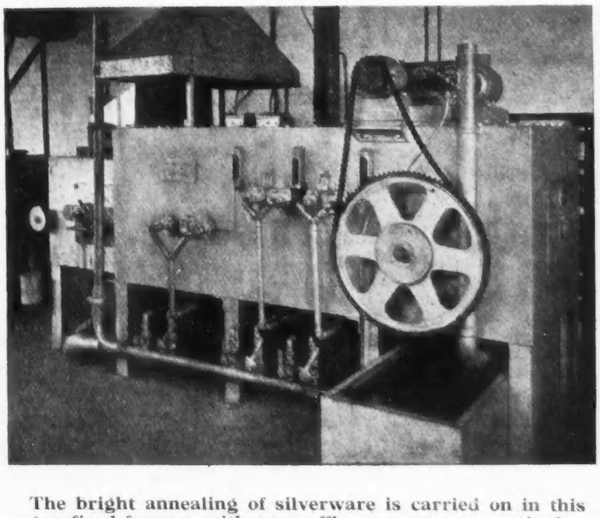
THE use of coal gas in industry is steadily increasing. The accompanying illustrations, among others, were used by Mr. Dean Chandler, of the South Metropolitan Gas Company, to show typical metallurgical applications, when delivering an address on "Gas in Industry and Commerce" at the Joint National Gas Conference, which was held at the Birmingham Section of the British Industries Fair. Taking a thermal efficiency of 55 per cent. for the furnace, the heating of one ton of steel to 900° C. needs only 17.5 therms of coal gas in a properly constructed gas-fired furnace, the heat absorbed by the steel being slightly more than 5.5 therms.



Left.—The Royal Mint provides a case where gas-firing has persisted since pre-war days, both for metal melting (as shown) and for furnaces used in annealing the coin blanks.



Using low pressure gas at 2.75 therms per hour, this reverberatory furnace is employed in treating lead dross at the rate of 3 tons per 24 hours, and has been in continuous use for four years.



The bright annealing of silverware is carried on in this gas-fired furnace without muffle, accurate proportioning of the air-gas mixture giving the correct atmosphere for preventing oxidation.

British Overseas Chemical Trade in February

According to the Board of Trade returns for the month ended February 29, 1936, exports of chemicals, drugs, dyes and colours were valued at £1,662,654, as compared with £1,658,985 for February 1935, an increase of £3,669. Imports were valued at £905,334, as compared with £861,076. Re-exports were valued at £39,132.

Imports

	Quantities. February. 1935.	Quantities. February. 1936.	Value. February, 1935. £	Value. February, 1936. £
Acids—				
Acetic .. .. cwt.	12,471	11,590	17,997	15,739
Boric (boracic) .. ,,	2,516	8,000	2,478	8,121
Citric .. .. ,,	1,790	3,567	6,007	12,883
Tartaric .. ,,	1,320	3,845	5,607	15,483
All other sorts .. value	—	—	11,207	16,733
Borax .. .. cwt.	14,801	7,901	7,403	4,899
Calcium carbide .. ,,	92,374	84,995	51,450	43,097
Fertilisers, manufactured—				
Superphosphate of lime tons	4,344	2,808	8,390	5,630
All other descriptions ,,	3,787	1,704	19,574	7,961
Phosphorus .. cwt.	4	—	22	—
Potassium compounds—				
Caustic and lyes cwt.	11,337	9,288	12,870	10,470
Chloride (muriate) ,,	46,632	23,080	13,895	8,274
Kainite and other mineral potassium salts elsewhere specified cwt.	256,507	156,293	33,906	19,044
Nitrate (saltpetre) ,,	8,158	5,295	7,759	4,497
Sulphate .. ,,	19,524	14,970	6,619	3,758
All other compounds ,,	8,343	9,131	13,688	13,484
Sodium compounds—				
Carbonate, including crystals, ash and bicarbonate .. cwt.	95	451	57	374
Chromate and bichromate .. .. cwt.	4,010	1,895	5,366	2,585
Cyanide .. ,,	2,160	4,714	5,058	11,777
Nitrate .. .. ,,	79,867	12,000	17,608	2,635
All other compounds ,,	11,826	31,841	10,180	17,685
Other chemical manufactures .. .. value	—	—	182,263	229,045
Drugs and medicinal preparations—				
Quinine and quinine salts .. .. oz.	68,493	66,406	5,807	5,684
Medicinal oils .. cwt.	2,564	5,673	9,894	11,197
Proprietary medicines value	—	—	67,469	30,967
All other sorts .. ,,	—	—	27,810	53,071
Dyes and dyestuffs and extracts for tanning—				
Finished dyestuffs (coal tar) .. .. cwt.	2,575	4,462	68,104	125,686
Extracts for dyeing ,,	4,062	6,168	9,678	14,224
Extracts for tanning (solid or liquid)—				
Chestnut .. cwt.	20,648	21,977	14,168	14,922
Quebracho .. ,,	124,722	72,173	71,328	62,325
All other sorts .. ,,	22,095	23,232	16,619	16,900
All other dyes and dyestuffs .. .. cwt.	1,014	1,159	16,701	12,503
Painters' and printers' colours and materials—				
White lead (basic carbonate) .. cwt.	7,396	6,681	8,322	8,368
Lithopone .. ,,	12,672	18,514	7,990	11,829
Ochres and earth colours cwt.	41,597	14,990	12,889	5,016
Bronze powders ,,	1,425	1,470	10,234	9,619
Carbon blacks .. ,,	26,793	25,539	37,761	37,121
Other pigments and extenders, dry .. cwt.	23,128	20,408	7,334	6,135
All other descriptions ,,	15,970	12,812	29,564	25,593
Total .. .. value	—	—	861,076	905,334

Exports

	Quantities. February. 1935.	Quantities. February. 1936.	Value. February, 1935. £	Value. February, 1936. £
Acids—				
Citric .. .. cwt.	1,886	2,235	7,205	9,576
All other sorts .. value	—	—	19,878	19,862
Aluminium compounds tons	1,859	1,811	21,821	17,199
Ammonium compounds—				
Sulphate .. tons	25,504	14,537	146,479	87,530
All other sorts .. ,,	2,820	5,457	33,013	51,416
Bleaching powder (chloride of lime) .. cwt.	42,871	44,771	14,121	12,794
Coal tar products—				
Cresylic acid .. gal.	102,752	169,081	8,622	14,474
Tar oil, creostoe oil, etc. gal.	1,460,575	2,013,849	33,406	54,037
All other sorts .. value	—	—	11,720	17,884
Copper, sulphate of tons	2,522	3,035	33,531	43,482
Disinfectants, insecticides, etc. .. .. cwt.	25,682	23,914	52,313	48,555
Fertilisers, manufactured tons	12,984	19,875	61,069	66,261
Glycerine .. .. cwt.	17,928	8,962	40,656	21,630
Lead compounds .. ,,	11,455	12,622	13,358	20,319
Magnesium compounds tons	406	367	9,332	9,462
Potassium compounds cwt.	3,342	5,943	8,826	9,083
Salt (sodium chloride) tons	18,208	20,272	50,435	49,774
Sodium compounds—				
Carbonate, including crystals, ash and bicarbonate .. cwt.	359,641	295,588	90,791	71,373
Caustic .. .. ,,	226,647	167,349	113,439	84,071
Nitrate .. .. ,,	12,134	11,283	4,533	3,738
Sulphate, including saltcake .. cwt.	13,287	17,737	2,407	2,132
All other sorts .. ,,	52,098	57,426	71,237	76,125
Zinc Oxide .. tons	1,072	1,340	18,681	24,635
All other descriptions value	—	—	167,794	191,726
Drugs and medicinal preparations—				
Quinine and quinine salts .. .. oz.	90,986	111,613	9,794	11,157
Proprietary medicines value	—	—	111,245	133,026
All other descriptions ,,	—	—	121,782	129,570
Dyes and dyestuffs and extracts for tanning—				
Finished dyestuffs (coal tar)—				
Alizarine, alizarine red and indigo (synthetic) cwt.	882	2,128	5,752	14,441
Other sorts .. ,,	4,315	6,812	68,152	84,736
All other descriptions ,,	28,543	15,516	32,291	20,641
Painters' and printers colours and materials—				
Ochres and earth colours cwt.	13,182	11,270	11,725	11,325
Other pigments and extenders, dry .. cwt.	19,001	18,000	26 758	23 735
White lead .. ,,	11,489	6,453	20,057	11,034
Paint and painters' enamels, prepared cwt.	35,597	34,187	91,992	91,200
Varnish and lacquer (clear) .. gal.	83,156	70,596	33,172	26,739
Printers' ink .. cwt.	4,211	4,670	26,950	26,560
All other descriptions ,,	29,819	35,756	64,648	71,352
Total .. .. value	—	—	1,658,985	1,662,654

Re-Exports

	Quantities. February. 1935.	Quantities. February. 1936.	Value. February, 1935. £	Value. February, 1936. £
Chemical manufactures and products .. value	—	—	13,936	26,234
Drugs and medicinal preparations—				
Manufactured or prepared .. .. value	—	—	9,884	10,175
Dyes and dyestuffs and extracts for tanning cwt.	6,386	1,221	5,158	1,295
Painters' and printers' colours and materials cwt.	304	338	664	1,428
Total .. .. value	—	—	29,642	39,132

Chemical Standards

Work of the British Standards Institution

DR. E. F. ARMSTRONG, chairman of the chemical divisional council of the British Standards Institution, opened a discussion on chemical standards at a meeting of the Yorkshire Section of the Society of Chemical Industry at Leeds University on March 9. The term "co-ordination" rather than "standardisation" better described the progressive movement represented by the Institution, he said. Its work in no way stultified progress or restricted design because it did not in any way set up unalterable standards. Indeed, standardisation properly organised and with the necessary safeguards of review and revision rigidly complied with, prevented any fear either of over-standardisation or of unsuitable standards being foisted on to an unwilling public.

The chief advantages of standardisation were that it aimed at elimination of waste in time and money in industry due to unnecessary variations, and at the setting up of minimum standards for reliable qualities of products; it helped manufacturers by focusing demand on limited types and grades, eliminating specials, and so allowed of steady production in larger units with more permanent employment; it helped the merchant by allowing concentration on fewer staple lines easy to buy and quick to sell; and it helped consumers by widening the source of supply, allowing of prompter delivery and giving assurance of a reliable quality of product at a reasonable cost.

With regard to disadvantages, it was only when standardisation was improperly organised by being either unrepresentative or too restrictive that it might lead to domination by one aspect or another, either by over-emphasis of users, manufacturers or research institutions, crystallisation or over-standardisation.

An Enlarged Organisation

The chemical industry associated itself with the British Standards Institution (then known as the British Engineering Standards Association) in 1931. The industry had for some time been watching the progress of standardisation in the engineering and allied industries and felt that efforts in the same direction would be advantageous to chemical interests. Realising that it was undesirable to have more than one standardising organisation in Great Britain, the representatives of the industry invited the Association to confer with them as to a possible enlargement of its scope to include chemical interests. As a result is was agreed to form one enlarged organisation, and a supplementary Royal Charter authorised the new title of the British Standards Institution, with divisional councils dealing with building, chemicals, engineering and textiles.

The first meeting of the chemical divisional council was held in May, 1931, and its progress had been more rapid than was anticipated, entirely justifying the decision of the chemical interests to do the work on a national basis. The work in hand covered a wide field, and included vegetable and fish oils, tar products, solvents, carbide of calcium, electroplating chemicals, leather and tanning chemicals, disinfectants (tests), dairy standards (tests), glues and gelatine (tests), plastics, symbols and abbreviations, and laboratory ware, including scientific glassware. A gratifying feature of the activities of the division was the readiness of those organisations which had done pioneer work in standardisation to place their results at the disposal of the Institution.

REGULATIONS governing the trade in compressed and liquefied gases were modified by an order of the Reich and Prussian ministers of national economy effective from January 1, 1936. Outstanding features of the new regulations are more exacting requirements with regard to the strength, construction and testing of the steel cylinders commonly used as containers.

Production of Ammoniated Peat

A Fertiliser of High Nitrogen Content

THE publication of the last of a series of reports by the United States Bureau of Chemistry and Soils on the production of ammoniated peat opens up the possibility of obtaining a valuable fertiliser of high nitrogen content from this material.

These results have so far only been obtained with small-scale laboratory experiments, but there would not appear to be any considerable difficulties in the way of large-scale manufacture. It has been found that one of the chief constituents of the water-soluble nitrogen compounds in ammoniated peat is urea. This was to be expected, since the conditions essential in ammoniating peat are similar to those necessary for the synthesis of urea. The decomposition of peat under these conditions of temperature, pressure, ammonia supply, etc., produces carbon dioxide, which, in the presence of ammonia, forms ammonium carbamate. This is the first stage in urea synthesis. Optimum conditions for these reactions are a temperature of not less than 155° C. and a pressure of 100 atmospheres, and by using ammonia in excess up to about 300 per cent. an 85 per cent. yield can be obtained.

No Moisture Absorbing Propensities

If urea could be synthesised simultaneously with the ammoniation of peat it should be possible to obtain a material of high nitrogen content without the objectionable hygroscopicity or moisture-absorbing propensities of urea. Methods for achieving this double purpose in one operation have been worked out and proved successful on a laboratory scale. The materials required are: freshly prepared ammonium carbamate, air-dried peat, anhydrous ammonia, and carbon dioxide. Products containing up to 70 per cent. or more of urea were obtained, but the best maximum limit for this was in the neighbourhood of 60 per cent., at which limit the product could be used under very humid conditions without losing its friability. The major portion of the nitrogen is water-soluble, and under the right operating conditions the insoluble nitrogen is also highly active. If these results are confirmed on a large scale it appears evident that a suitable carrier has been found for urea as a solid, thus providing a further outlet for the utilisation of peat and a valuable addition to our nitrogenous fertilisers.

A subsequent comparative study was made of ammoniated peat, lignin, dextrin and starch, fractionated with various solvents, the results of which showed that urea is the only common product present in large quantities, and is partly formed from carbon dioxide liberated during ammoniation. It would seem, therefore, that both the carbohydrate and lignin constituents of peat are extensively ammoniated; and, further, that an essential part of the process is decarboxylation, with formation of carbon dioxide. It follows that it is desirable to increase the potential carboxylic acid content of the peat to a maximum. Another important point is that the ammonium salts should be as completely transformed (into amides) as possible, in order to avoid loss of ammonia in storage. This means that, in the process of ammoniating, the peat must be sufficiently heated to ensure this conversion into amides, and at the same time excessive heating must be avoided, since this would unduly increase the proportion of insoluble nitrogenous products which cannot be converted into a soluble and usable condition.

IT is reported from Odessa that tellurium has been produced from Cottrell precipitator dust recovered at a phosphate plant. The dust was mixed with hydrochloric acid and boiled for four or five hours after which it was treated with potassium chlorate as an oxidising agent producing telluric acid. The latter was reduced by boiling to tellurous acid and, after dilution with two or three times its volume of water, reduced with sulphur dioxide to metallic tellurium.

Anthraquinone Dyestuffs

Relationship Between Cis- and Trans-Isomerism

THE development of anthraquinone chemistry from the seventies of last century when the constitution and synthesis of alizarin were first worked out, was summarised by Dr. Fraser Thomson, of Scottish Dyes, Ltd., in a paper read before the Scottish Section of the Society of Dyers and Colourists at Glasgow on March 6, Mr. John Muir, M.A., presiding. Progress, said Dr. Thomson, first took place with the acid alizarin colours, dyeing wool without mordants, but the most important landmark was the discovery of indanthrone in 1900, probably arising out of attempts to apply the alkali fusion technique to 2-anthraquinonylglycine instead of phenylglycine as in the manufacture of indigo.

The anthraquinone vat colours were then dealt with and a few salient points picked out of the various classes, such as indanthrone and its halogenated and other derivatives, flavanthrone and pyranthrone, acylaminoanthraquinones, acridones, polyanthrimides, anthrimide carbazoles, thiazoles, dibenzanthrones and derivatives of other homocyclic types, including the naphthoylene iminazoles. Comparisons were made showing the relationship between cis- and trans-isomerism throughout the field, cis- derivatives in general being more deeply coloured than the trans- derivatives. Reference was made to some types of recent research, particularly relating to mixed imides.

A further branch of anthraquinone chemistry relates to the colours for cellulose acetate, consisting essentially of amino-anthraquinones, and, finally, the solubilised vat colours (Soledons and Indigosols) were briefly discussed and reference was made to the constitution of the tetra esters of indanthrone. In conclusion, Dr. Thomson pointed out that a considerable number of the anthraquinone vat colours could now be considered to be as brilliant in shade as the corresponding basic colours.

The Institute of Export

Membership Reaches 250

THE Institute of Export, the formation of which was announced nearly two months ago, has made excellent progress and its corporate membership already numbers about 250. Export executives throughout the country have welcomed the formation of a professional organisation relating to export trade, and the Institute, in fact, crystallises the ideas which have been forming independently in the minds of many who have the interests of British export trade at heart. Already the Institute has been bombarded with many schemes for export development and the consideration of problems confronting exporters. This has necessitated the appointment of a number of committees for dealing with research, education, development and social activities, to say nothing of the large number of applications for membership which must be carefully scrutinised in order to ensure that admission to the corporate class carries the hall-mark of real ability and experience in export.

The Institute held its first ordinary meeting on February 26, when Mr. Robert Haylor, barrister, spoke on "The Law of C.I.F. Contracts." The Institute has a busy programme before it and a wide field to cover. Its immediate programme will comprise addresses on "Government Assistance to Export Trade, by an official of the Department of Overseas Trade; "The British Colonial Market—Britain's Largest Export Market," by Major W. E. Simnett; "A Banker's Advice to Exporters," by Mr. W. J. Thorne (Westminster Bank, Ltd., Foreign Branch Office); "The International Telephone and the British Exporter," by Mr. M. C. Pink (Deputy Controller, Post Office Telephones); "New Ideas on Packaging for Export," by Mr. Milner Gray; and "A Marine Insurance Expert's Advice to Exporters," by Mr. Browning Dick.

Sprayed Metal Coatings

Obtaining Protection Against Corrosion

A RÉSUMÉ of existing knowledge upon the use of sprayed metal coatings for combating various types of corrosion was given by Mr. Noel H. Kitchen, of Yorkshire Metal Sprayers, Ltd., at a meeting of the West Riding Section of the Society of Dyers and Colourists at Bradford on March 12.

In his opening remarks Mr. Kitchen explained that the metal to be sprayed was fed into a blowpipe flame by means of the metal spraying pistol. In this flame the metal is melted, and the molten drops are met by a stream of compressed air travelling at high velocity. The metal disintegrates into fine particles, and forms a spray which is driven at approximately 800 miles an hour on to the surface to be sprayed, which is previously sand-blasted to provide a clean rough key.

Outlining the characteristics of sprayed metal, he pointed out that the particles of metal are possibly spherical when formed, but their impact with the molecules of the atmosphere alters their shape. They are probably solid when they strike the surface to be coated, but at the moment of impact they most probably become semi-fluid or plastic because each particle takes the form of a saucer with thick edges. Therefore, the sprayed layer is built up of saucer-shaped particles of metal partially covered with a very thin oxide skin, and this is a unique metallurgical structure.

Aluminised Steel

In discussing the protective value of sprayed metal coatings Mr. Kitchen used samples of aluminised steel to show the value of aluminising for the prevention of heat corrosion. Examination of these samples, which had been partially aluminised and partially untreated, and had been subjected to 1,000° C. for 16 hours, showed that in the parts that had been treated no corrosion took place, and that considerable corrosion occurred where the steel was untreated.

Both atmospheric and electrolytic corrosion can be prevented by metal spraying. Zinc coatings and aluminium coatings are chiefly used for the prevention of atmospheric corrosion. Tin coatings, and also aluminium coatings, are used to a great extent for the prevention of contamination and corrosion in the foodstuffs industries. Nickel coatings also have their uses. Lead coatings are extensively used in the chemical industries, whilst copper, brass and bronze coatings have their own applications. Statistics were given to show the great increase of the use of metal spraying in this country since 1922. The area of zinc sprayed in 1922 was 6,000 sq. ft.; in 1930 it was 300,000 sq. ft., and in 1935 approximately 2,780,000 sq. ft. had been sprayed.

A series of slides was shown illustrating various applications of metal spraying. The practical use of aluminising was shown by a slide of two stoker links which had worked side by side for some months. One link which was untreated was seen to have a burnt-away surface, whilst the edges of the aluminised link were perfectly clean. Slides were also shown concerning the use of sprayed zinc for the prevention of corrosion in crude oil tanks, viscose blenders for the artificial silk industry, and hydro extractor baskets. Illustrative of tin coatings other slides showed large pans internally sprayed with heavy coatings of tin for the foodstuffs industries, refrigerator coils and large impellors.

CZECHOSLOVAK fertiliser consumption increased during 1935 as a result of the operations of the Grain Monopoly which, by increasing and stabilising the prices for grains and other farm products at levels considerably above world price levels, gave stimulus to an increasing intensification of agriculture. The extremely active occupation of the domestic steel industry accounted partly for the increased consumption of basic slag.

Chemistry Applied to Petroleum

A Stimulating Lecture by Dr. A. E. Dunstan

A MEETING of the Manchester Section of the Society of Chemical Industry was held at the Engineers' Club, Manchester, on March 6, when Dr. A. E. Dunstan delivered a lecture on "Chemistry Applied to the Petroleum Industry." Mr. A. McCulloch presided.

From the time when petroleum was regarded as a chemical curiosity, and when the refining of the oil was little more than mere oil-boiling, comparatively few years have elapsed, yet during that short period there has been developed on scientific lines an industry of outstanding importance. Even so, the development of the technology of petroleum continues apace, hence what is good practice to-day may be bad practice to-morrow. In discussing this theme, Dr. Dunstan, in his customary lucid and interesting style, gave an account of the part which the chemist has played and is playing in the development of the industry. At the present time the annual output of petroleum throughout the world is about 250 million tons, whilst the volume of gaseous hydrocarbons, saturated and unsaturated, obtained as casing-head gas and from cracking processes, is so great as to be almost incalculable. Until quite recent times the so-called natural gas was used almost exclusively either as fuel or in the production of carbon black. To-day, however, pyrolytic treatment has largely replaced the older and wasteful method of utilisation, thereby producing large quantities of motor spirit.

After discussing the principles of "knocking," and the use of "anti-knock" substances, Dr. Dunstan described the newer researches which had led to the production of iso-octane from casing-head gas. He then dealt with the work of Ipatiev on the use of phosphoric acid as a catalyst and with the investigations of Edeleanu into the refining of liquid hydrocarbons and the purification of lubricating oils by liquid sulphur dioxide, and concluded his address with some observations on the chemistry of Diesel oils.

A vote of thanks, proposed by Professor T. P. Hilditch and seconded by Mr. J. E. Bennion, was accorded Dr. Dunstan for his stimulating lecture.

Oil Burner Manufacturers

Progress in Standardisation

THE second annual general meeting of the British Oil Burner Manufacturers Association, preceded by a luncheon, was held recently at the Connaught Rooms. Mr. F. L. Bolt, of the Wallsend Slipway and Engineering Co., Ltd., who was in the chair both at the luncheon and meeting, was elected president in succession to Mr. F. H. Horton. Mr. O. Meikle and Mr. R. Sutton were elected vice-presidents, whilst Mr. W. A. Hubbard was re-elected hon. secretary. Mr. R. L. Cox was elected to a seat on the council.

Mr. BOLT, in reviewing the activities of the Association during 1935, mentioned that the main thing accomplished had been the drawing up of a standard of design, manufacture and installation of automatic oil burner equipment for central heating and hot water supply. This had, towards the end of the year, been submitted to the British Standards Institution with a request that steps might be taken with a view to its adoption as a British standard. A technical committee of the Institution, on which the Association is represented, is dealing with this matter.

Mr. Bolt also referred to the fact that the Association was represented on a sub-committee of the Institution, which is preparing a British Standard for fuel oils for burners. A technical sub-committee of the Association is giving consideration to a proposal for the fixing of a nameplate to every oil burner plant.

The Association has decided to provide an oil burner exhibit at the Building Centre, 158 New Bond Street, designed to bring to the notice of architects and others the advantages of automatic heating with fuel oil. During the past year the Association has been approached by technical bodies with a view to nominating members to serve on committees dealing with technical matters connected with the fuel oil and oil burner industry.

New associate members from amongst those who supply auxiliary equipment include British Arca Regulators, Davidson and Co. (Belfast), Fredk. Braby and Co., Fraser and Fraser, Ltd., C. G. Vokes, Ltd., John G. Stein and Co., and G. A. Harvey and Co., Ltd.

Paraffin Wax from Petroleum

An Outline of American Practice

THE economic importance of paraffin wax has warranted publication by the United States Bureau of Mines of a detailed treatment of the manufacturing processes and equipment used in the production of paraffin wax from petroleum (Bulletin 388, "Manufacture of Paraffin Wax from Petroleum). In this bulletin R. H. Espach has gathered data from wax-manufacturing refineries in various parts of the country whose output of wax at the time the study was made represented more than 75 per cent. of the United States paraffin wax production, illustrations of equipment for processing wax distillate and manufacturing paraffin wax being given.

Wax is a necessary by-product in the manufacture of most lubricating oils and is a valuable product of the refining of many crude petroleums. The removal of wax from lubricating-oil fractions is a rather expensive refining operation. The equipment necessary for wax removal is costly, but it has long life and its maintenance costs are low. The equipment for finishing crude wax into commercial products is not costly compared with that for removing the wax from the oil. As the cost of wax removal is chargeable to the lubricating oil, the actual refining of the crude wax into commercial products should be profitable even with the low prices for wax that have obtained for several years.

The quantity of wax exported from the United States in 1931, and all previous years for which there are records, exceeded the domestic demand. Since 1931 the quantity of exported wax has been less than the domestic demand for wax, and in 1933 was about 70 per cent. of the domestic demand. The imports have not been more than 8 per cent.

Varied Industrial Uses

Paraffin wax has many uses because it has convenient melting points, will bend and is tenacious at ordinary temperatures, does not deteriorate, is impervious to water at atmospheric temperatures, and has a high dielectric strength. It is used extensively in the manufacture of candles; the impregnation of waxed papers; the coating of paper cartons (butter, cheese, ice cream) and milk-bottle tops; electrical insulation; waterproofing; the impregnation of match tips; floor and furniture polishes; laundering; the protection of preserves and jams from fermentation; coatings for cheeses to improve their appearance and to prevent mould, evaporation, and shrinkage; the lining of butter tubs; coatings for vats and barrels (vinegar, cider, alcohol, whisky, molasses, and sauerkraut); coatings for meats, sausages, and other products which must be prevented from drying; protective wax dressings for burns; the manufacture of artificial flowers; etching glass; waxing yarns in the textile industry; and stuffing or loading for leather.

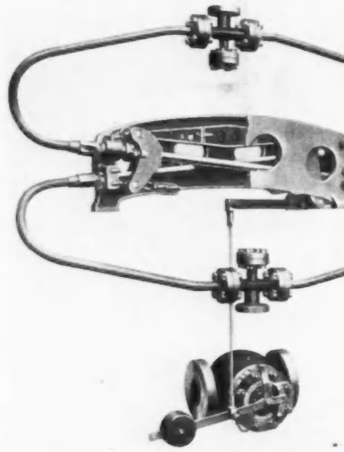
To establish a suitable foundation for the descriptions of manufacturing equipment and processes a section of the present bulletin deals with the properties of paraffin wax, such as melting point, colour and appearance, tensile strength, oil and moisture content, and solubility. The batch, continuous, vacuum, and coke or re-run methods of processing wax distillates are discussed. Various types of wax-chilling equipment and the methods and equipment for filter-pressing chilled wax distillate are given detailed treatment.

Works Equipment News

Boiler Feed Water Regulators

THE advantages of automatic feed water regulation for the operation of steam boilers in general do not require emphasis. For water tube boilers, now being more and more used in the chemical industries, the use of regulators is essential because of the relatively low water content, and they are an important aid to economy in the case of Lancashire and other cylindrical boilers.

In this connection the "Duo" regulator, supplied by Hopkinsons, Ltd., is of special interest. Regulators of this type



Hopkinsons' "Duo" Patent Feed Water regulator with control valve in the feed pipe line (Hopkinsons, Ltd.)

are operating at a number of the works belonging to Imperial Chemical Industries, Ltd., including British Dyestuffs, Ltd. (Huddersfield), Brunner Mond and Co., Ltd. (Northwich), and United Alkali Co., Ltd. (Fleetwood), as well as at Boots Pure Drug Co., Ltd. (Nottingham), Cerebos, Ltd. (Grantham), and British Industrial Solvents, Ltd. (Hull).

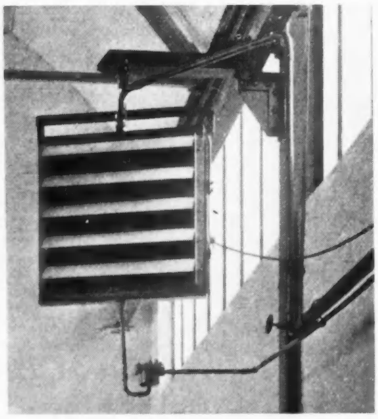
Essentially the controlling force of this regulator is derived from the expansion of two crossed inclined metal tubes in circuit with the boiler, the lower half being filled with water and the upper half with steam, varying according to the water level in the boiler drum. As a result the steam portion of the tubes is much hotter than the water portion, the latter being locally not much over 150° F. since the arrangement is exposed to the air, and the tubes therefore contract or expand as the water level rises or falls, actuating a sensitive feed control valve. The main feature of this "Hopkinson" expansion tube design is that two oppositely inclined tubes are used, which not only gives the same range of regulation as one very long tube, a 1 inch vertical difference in the boiler water level being equal to 12 inches travel in the two tubes together, that is, 6 inches for each tube, but has also other practical advantages. Thus, instead of a long unsightly tube arrangement, there is a neat and strong framework of relatively small size with a "double" action on the control valve and increased radiation effect for the water portion.

The device consists of a horizontal heavy rigid steel frame which carries the expansion tubes and other equipment between a front and back steel plate, fixed in any desired position adjacent to the boiler drum. The inclined tubes are made of special non-corrosible metal with a high coefficient of expansion, and pipe connections from each of the top ends lead to a central connection piece which forms the inlet to the steam space of the boiler. From the lower ends of the inclined tubes are pipes leading to a similar central connecting piece and the water space of the boiler. The expansion and contraction movement of both the tubes also is linked together and actuates a weighted arm at the lower part of the frame. In turn, this arm connects by a rod to the weighted lever arm of a control valve in the feed pipe circuit, situated at any reasonable distance from the regulator.

A typical arrangement is to fix the regulator directly above the control valve using a vertical straight rod from the arm of the regulator to the lever arm of the valve, which is opened and closed within very fine limits as the water level in the boiler changes. All the operating mechanism is carried on knife edges, resulting in minimum friction, while the tubes operate under tension. One of the most important points is that the flow of the feed water is practically constant in relation to the degree of the opening, giving smooth regulation, that is, unlike a "mushroom" valve, the amount passed corresponding to unit degree of lift is not greater at the commencement of the travel as compared with, say, the middle portion of the latter.

Unit Heaters for Drying Rooms

CONSIDERABLE economies are now being effected in many processes where drying is to be carried out by using "Spiral Tube" air heaters in a drying chamber. The unit heater is supplied with steam and delivers a large volume of hot air into the drying room. Fresh dry air is admitted into the chamber through the heater and the moisture-laden air is expelled through a vent. This system is being used for the drying of chalk, sweetmeats, artificial leather, plaster board, etc. The accompanying illustration shows a standard unit heater as installed for heating the air in a room; special models are made for special duties, or where air is required at a very high temperature. Such heaters are easy to instal or move to a new position, have low running costs, and are capable of deflecting the warm air wherever desired. First cost and installation is less than the equivalent cost for ordinary pipe heating. The No. 2 size, measuring 24 inches × 24 inches, give a heat output of 4,000 B.Th.U. per minute, utilising steam at a pressure of 15 lb. per sq. inch. The makers are The Spiral Tube and Components Co., Ltd.



Standard "Spiral Tube" Unit Heater.

Air-Driven Ultra Centrifuges

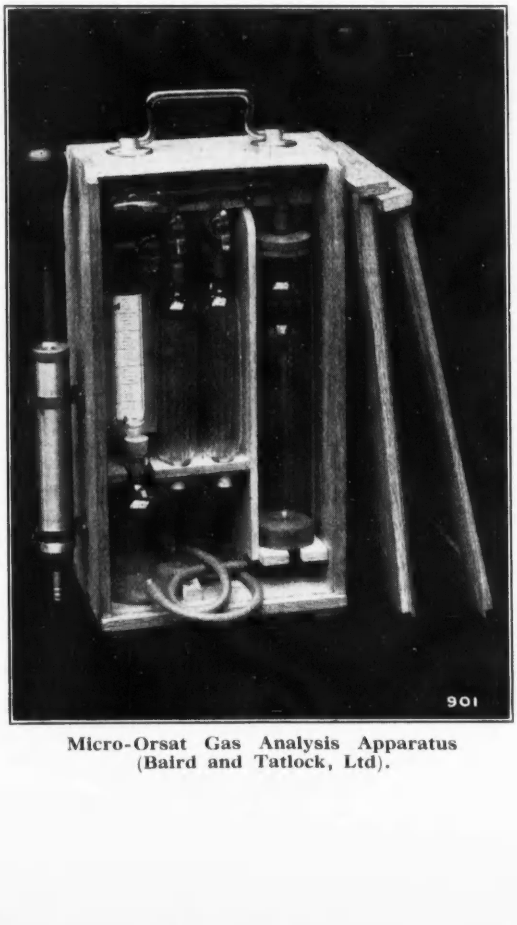
THE demand for increased speed for centrifuges, especially for virus investigation, has led to the adoption of new principles in construction. Baird and Tatlock, Ltd., are now supplying a machine made on the principle devised by MM. Henriot and Hugnenard, modified by Professor McIntosh, which gives a maximum attainable speed of 50,000 r.p.m.

The centrifuge itself consists of a rotor of duralumin, coned at the bottom, radial grooves being cut on the cone. The top is flat, with four recesses to accommodate four glass tubes

2 × 0.5 cm. shielded by rubber buffers at the points. To hold the tubes in the recesses a ground metal disc is provided secured by a bolt. In the top of this bolt is fixed a hardened steel pin with knob, which enables the operator to lift the rotor from the stator while it is rotating, with the special fork provided with the outfit. This rotor corresponds to the plate or head on an ordinary centrifuge, and is separate from the stator, which consists of a metal funnel, fitted with an adjustable choke in the nozzle and screwed into a metal cylinder, which is supported in a tripod stand by rubber straps.

Air-Driven Ultra Centrifuge (Baird and Tatlock, Ltd.)

Air is blown through the inlet tube into the stator cylinder, and issues through small vents drilled at an angle through the funnel wall. This forms a vortex of air above the stator, and to start the machine the rotor is held by hand and gently lowered into the funnel. As it gets closer it is drawn down by the vortex till it gets within a fraction of a millimetre of the rim, when it is in turn repelled by the escaping air. The rotation of the vortex, at the same time acting on the grooves cut in the rotor, starts it spinning, and the rotor is thus supported and rotated entirely by the vortex of air above the stator.

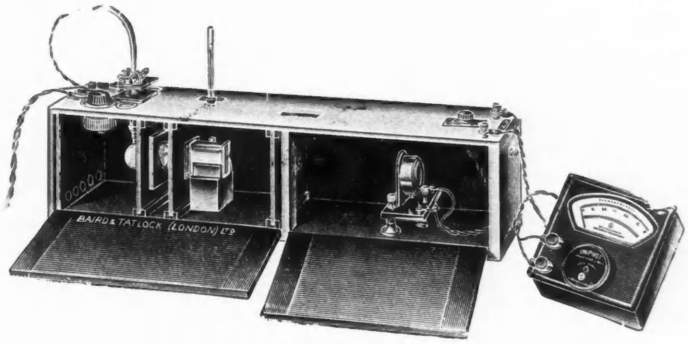


Micro-Orsat Gas Analysis Apparatus (Baird and Tatlock, Ltd).

A Gelatine Clarity Tester

THE grading of gelatine solutions by their degree of clarity is considerably facilitated by the use of the I.C.I. gelatine clarity tester, which is supplied by Baird and Tatlock, Ltd.

For this purpose "clarity" is defined as the percentage of light transmitted by the solution compared with that transmitted by distilled water measured under the same conditions. The solutions to be tested are contained in 2-inch glass-ended troughs such as are used for colour measurement in the Lovibond tintometer. The troughs are placed in the path of a parallel beam of light (from a tungsten filament) suitably stopped to minimise reflection from the walls of the vessel and from the meniscus of the liquid. The light transmitted is received on the sensitive face of a photo-electric cell and is measured by a micro-ammeter, the reading on which for distilled water is adjusted to the value 100 m.a. by varying the lamp resistance (a coarse adjustment) or the galvanometer shunt resistance (a fine adjustment).



I.C.I. Gelatine Clarity Tester (Baird and Tatlock, Ltd).

When the trough containing the solution to be examined is substituted for that containing the distilled water the reading given by the ammeter records directly the defined clarity ratio. This clarity ratio is independent of quite large variations in the intensity of the light source, and infra red rays from the light source are without appreciable effect since they are absorbed in distilled water and the aqueous solution.

Miniature Gas Analysis Apparatus

MINIATURE apparatus for gas analysis, combining accuracy and speed of operation with extreme lightness, is now obtainable. The Micro-Orsat apparatus illustrated has a case measuring only $12\frac{3}{4} \times 6\frac{7}{8} \times 3\frac{3}{4}$ inches overall. The burette reads directly in percentages and is calibrated in a novel way to correct the volume for draught or partial vacuum in the flue while the sample is being taken. This method of calibration avoids the necessity of withdrawing the plug of the three-way stopcock and thus opening the pipe-line to the atmosphere. A built-in draught gauge may be readily connected with the flue by means of a three-way stopcock. By turning the stopcock a reading is obtained of the draught in the flue without any further connection, thus enabling the operator to obtain this reading at the same time as the gas analysis is made. Provision is made for holding a special brass exhaust pump fitted with ball valve. The apparatus is supplied by Baird and Tatlock, Ltd.

CALCIUM carbide imports into Argentina increased during 1934 over the previous two years. Soviet Russia, an inconsequential supplier in 1932 and 1933, accounted for the increased receipts, other important suppliers, except Poland and Switzerland, having suffered losses in volume. Principal imports in 1934 were: Sweden 2,531 metric tons; Russia 1,560; Switzerland 955; Spain 861; Germany 730. Of the total imports of 7,798 metric tons, only three tons came from the United Kingdom.

Chemical Industry in Canada

Final Statistics for 1934

THE manufacture of chemicals and allied products was carried on in Canada by 736 separate plants in 1934, as compared with 696 in the previous year. The total capital investment in the latter year reached $156,788,418, whilst the 17,130 employees earned in all $20,919,740. The total value of production was $108,052,039, a gain of about 16.4 per cent. during the twelve months. About 55 per cent. (404) of the factories were located in Ontario, and these works produced 57 per cent. of the Canadian total output; Quebec had 219 establishments.

Canada's imports of chemicals advanced in 1934 for the first time since 1929, the year's total being $28,149,508, an increase of $4,000,000. Imports from the United States totalled $16,575,214 and from the United Kingdom $6,164,660. Canada's exports of chemicals rose during the year from $12,604,040 to $14,349,689; shipments to the United States represented 44.1 per cent. of the total, as against 22.7 per cent. to the United Kingdom.

The leading groups in the industry from the point of view of production value were those concerned with medicinal and pharmaceutical preparations ($14,316,005 in 1934, compared with $13,912,045 in 1933); explosives, ammunition and fireworks ($9,037,738 in 1934, compared with $7,378,732 in 1933); toilet preparations ($6,745,513 in 1934, compared with $5,912,162 in 1933); mixed paints; toilet soaps; bar household and laundry soap, soap chips and flakes; varnishes; sulphuric acid; printing inks; enamels; matches; ammonium sulphate; soap powders; nitrocellulose lacquers; oxygen; acetylene (compressed or dissolved); floor waxes and polishes; and cleaning or scouring pastes and powders.

Canada's imports in 1935 of chemicals and allied products totalled $29,757,570, of which the United Kingdom supplied $6,330,811 and the United States $17,458,742. Exports during the year were valued at $16,372,476, including $7,983,454 sent to the United States and $3,022,098 shipped to the United Kingdom.

Glass Bottle Moulds

Desirable Quantities of Cast Iron

CAST iron for the manufacture of glass moulds was the subject of a joint paper by Mr. N. L. Evans (Imperial Chemical Industries, Ltd.), Mr. W. Goacher (Forster's Glass Co., Ltd.) and Mr. J. E. Hurst (Bradley and Foster, Ltd.) read at the 176th meeting of the Society of Glass Technology held in Sheffield on February 19, the president, Mr. B. P. Dudding, A.R.C.Sc., F.Inst.P., being in the chair.

Material for glass bottle moulds, said the joint authors, requires to have good casting and machining properties and be capable of taking a fine polish, and at the same time it must be resistant to heat and should scale as little as possible. The use of expensive alloy irons cannot usually be justified and very satisfactory results can be obtained by the use of properly selected refined pig irons. The glass entering parison moulds has a temperature of 900-1,000° C., and the moulds themselves reach a temperature of approximately 500° C. on the inside. The skin temperature on the inside, however, must be much higher than 500° while the hot glass is actually in contact with it, as it is sufficient to cause scale to form on the iron. As the moulds are air-cooled on the outside there is a considerable temperature gradient between the inside and the outside which sets up fairly considerable stresses in the iron.

Moulds in continuous use last longer than those used intermittently for making the same number of bottles. This is explained by the mechanism of growth in cast iron. Growth is due partly to the breakdown of iron carbide in cast iron which takes place at a temperature of about 600° C. or over. The stable condition of cast iron is a mixture of iron and graphite and the change to this from iron carbide is accompanied by an increase in volume, the density of iron carbide being about 3½ times that of graphite. Growth tends to start cracks in the iron which act as channels along which oxidation will occur, causing still further increase in volume: alternative heating and cooling accelerates the formation of cracks on account of expansion and contraction. Graphite flakes which penetrate to the surface of the iron will also act as channels for oxidation.

When using refined irons for making glass bottle moulds, the composition should be adjusted to minimise growth. The total carbon content of the iron should be low in order that graphite flakes may be as small and as few in number as possible. The silicon should be present in sufficient amount relative to the thickness of the castings to produce approximately an all-pearlitic structure, that is, with no ferrite or iron carbide in the free state. The Brinell hardness of such an iron is usually between 215 and 235, and it can be readily machined. It is recommended that the phosphorus should not exceed 0.45 per cent., as there is some evidence that this element in larger proportions has a deleterious effect on iron subjcted to high temperature. Manganese should be fairly high as it helps to produce a fine grained structure, and sulphur should be kept as low as possible and not exceeding 0.07 per cent. While it is true that sulphur tends to stabilise iron carbide, its tendency to segregate in the form of mixed iron and manganese sulphide often produces unsoundness in the casting and hard patches difficult to machine.

According to the authors, iron for glass bottle moulds should meet the following specification:—Total carbon 3.1 per cent. maximum, silicon according to thickness of casting, sulphur 0.07 per cent. maximum, phosphorus 0.45 per cent. maximum, manganese 0.8 to 1.5 per cent. Variation in silicon content in relation to the prevailing thickness of the casting was shown by a chart, and the method of calculating the correct proportions in which to mix different grades of refined pig iron was explained, both for cupola and crucible melting.

Far Eastern Chemical Notes

Japan

MEDICINAL PRODUCTS CONTAINING AMINO ACIDS are to be manufactured at a factory now being built at Kawasaki by Takara Seiyaku K.K., a subsidiary of Suzuki Ajinomoto.

THE TOKIO FIRM OF TAKEDA CHOBEI contemplates the manufacture of active carbon, an article formerly imported from Germany.

WITH A CAPITAL OF 500,000 YEN, the Adachi Kogyo K.K. has been formed with the object of engaging in the manufacture of refined sulphur, about 200 tons of which are to be produced monthly.

A SATURATED HYDROCARBON isolated from hydrogenated sardine oil by Y. Toyama ("J. Soc. Chem. Ind. Japan," 1935, No. 6) has been identified as *n*-heptadecane (m.p. 22.5° C.). It is considered likely that this substance is a natural constituent of sardine oil.

THE TAIWAN HOSHI SEIYAKU K.K., with a fully paid-up capital of 1.25 million yen, has been established at Taihoku in Formosa by Hoshi Seiyaku K.K. and will principally engage (as reported in "Chemische Industrie") in the extraction of drugs, including cinchona, coca, peppermint and pyrethrum.

EXPERIMENTS conducted in Taiwan on new outlets for natural camphor indicate that it may be used in the manufacture of dyes, according to a Press report. Safrol produced from red camphor oil has been converted to amino-dihydro-safrol. It is stated that after diazotisation of this product and coupling, a whole range of scarlet, brown and orange azo dyestuffs have been produced.

Personal Notes

MR. LEONARD GOW, a director of the Burmah Oil Co., has died in his 77th year.

MR. JOHN YOUNG, 15 Correnuie Gardens, Edinburgh, formerly of Bearsden, Glasgow, retired shale oil company director, who died on November 22, left personal estate valued at £15,435.

SIR H. C. HAROLD CARPENTER, professor of metallurgy in the Royal School and Mines, Imperial College of Science and Technology, has received the honorary degree of Doctor of Metallurgy from Sheffield University.

BRIG.-GENERAL SIR HAROLD BREWER HARTLEY, vice-president and director of scientific research to the London Midland and Scottish Railway Co., and chairman of the Fuel Research Board, has received the honorary degree of Doctor of Science from Sheffield University. SIR FRANK EDWARD SMITH, secretary of the Department of Scientific and Industrial Research, and secretary of the Royal Society, has also received the same honour.

MR. HARRY LIVSEY, who rose from works boy to be chairman and managing director of the English Velvet and Cord Dyers' Association, has died at the age of 58. He started work as a boy with the Littleborough Dyeing Co., and when that firm was merged on the formation of the English Velvet and Cord Dyers' Association he was transferred to Manchester. His ability and knowledge of the textile dyeing industry gained him steady promotion, and in October last he was appointed to the post of chairman and managing director of the Association.

SIR FREDERICK NORMAN died suddenly at Runcorn on March 16, aged 78. He was for 57 years manager of Wiggs Chemical Works, Runcorn, now controlled by Imperial Chemical Industries, Ltd. Sir Frederick was known to chemists as the father of the wet-copper industry. He was the first to realise the advantages of the Cheshire side of the Mersey for the production of heavy chemicals, and since then he has tried to persuade the alkali trade to establish itself on the Cheshire shore. He earned notice from Disraeli for his part in the expansion of the superphosphate and allied industries that followed as a result of his firm giving the alkali trade cheap sulphur. He was a magistrate for forty-two years and a member of the Cheshire Standing Joint Committee. His gifts to Runcorn included a home for the aged poor, a new wing to the hospital, and a club-house for the golf club.

PROFESSOR A. C. SEWARD, F.R.S., has been appointed a member of the advisory council to the Committee of the Privy Council for Scientific and Industrial Research.

MR. WALLACE ELLISON, 44 Camphill Road, Broughty Ferry, until recently a director of Francis Stevenson and Sons, Ltd., Stevenson Bros. (Dundee), Ltd., and Donald Brothers, Ltd., has been appointed to an administrative post with the Bradford Dyers, Ltd.

MR. W. R. PERCY, of Nottingham, has died in his 82nd year. Mr. Percy was a well-known mining engineer and was the first engineer to erect a battery of coke ovens in England. He erected the ironworks at Bestwood and opened out the Eastwell Mines, Leicestershire, amongst other achievements.

MR. A. C. BROWN, a student in the pharmacy department of the Leicester College of Technology, has been awarded the silver medal of the Pharmaceutical Society for the best herbarium, consisting of not more than 150 plants collected in any part of the British Isles during the year. Mr. Brown's collection was nearly all from the Charnwood Forest, Leicestershire.

PROFESSOR JOHN SCOTT HALDANE, F.R.S., hon. professor and director of the Mining Research Laboratory, Birmingham University, died at his home, Cherwell, Oxford, on March 15. He was born in Edinburgh in 1860, the son of the late Robert Haldane. His elder brother was the late Lord Haldane, a former Secretary for War and founder of the Territorial Army. Professor Haldane had not long returned from a visit to Persia, where he had been to give advice in connection with heat stroke affecting some employees of the Anglo-Iranian Oil Co. He was one of the most eminent physiologists of the time and his discoveries in human physiology and their application to mining and engineering earned him a high reputation. For his research work the Royal Society awarded him the Copley medal in 1934. He had long studied questions of high temperatures and atmospheric conditions generally in relation to the health of the miner, and in 1904 was investigating methods to reduce dust and prevent silicosis. Professor Haldane was formerly demonstrator, and later reader, in physiology, Oxford University; Silliman lecturer, Glasgow University, 1927-28; president of the Institution of Mining Engineers, 1924-28; and Donnellan lecturer, Dublin University, 1930. He served on various Royal Commissions, and carried out numerous special inquiries for Government Departments.

Continental Chemical Notes

Hungary

FANTL AND PICK, of Vienna, have established a branch factory for essential oils and essences in Budapest.

Germany

PATENTS COVERING A PROCESS for the manufacture of fatty acids by oxidation of saturated hydrocarbons, formerly owned by the Markische Seifenindustrie, of Witten, have been taken over by the Deutsche Fettsäure-Werke G.m.b.H. which was recently registered at Witten with a capital of 600,000 marks.

Iceland

ARTIFICIAL FERTILISERS, in an annual output of 35,000 sacks calcium nitrate and 15,000 sacks mixed fertilisers (nitrogen, phosphoric acid and potash), are to be manufactured in Iceland.

Holland

AVIATION SPIRIT CONTAINING ISO-OCTANE is now marketed by the Koninklijke Petroleum Mij, and has a minimum octane value of 87 which can be increased to 95 by addition of tetraethyl lead.

Denmark

MANUFACTURE OF RUBBER PRODUCTS is contemplated at a new factory near Copenhagen by the Nordisk Gammi and Guttaperka A.S., owing to the import restrictions.

Poland

RECENT COMPANY FORMATIONS (as reported in the Chemische Industrie of Berlin) include Chem.-pharm. Fabrik Adolf Gasecki and Söhne, in Warsaw, with a capital of 850,000 Zloty (chemical, cosmetic and pharmaceutical products); Galen G.m.b.H., in Warsaw, with a capital of 36,000 Zloty (pharmaceutical chemical preparations).

France

ALUMINIUM PRODUCED BY ELECTROLYSIS OF ALUMINA in a bath of molten cryolite generally exhibits a maximum purity of 99.7 per cent. By means of a new refining process operated at the Saint-Jean-de-Maurienne factory of the Alais-Froges-Camargue concern, a purity of 99.99 per cent. is said to be achieved. It is claimed that aluminium manufactured by the new process has a higher electrical conductivity and a greater resistance to corrosion and alkalis.

Weekly Prices of British Chemical Products

THERE are no price changes to report in the markets for general heavy chemicals, pharmaceutical and photographic chemicals, perfumery chemicals and intermediates. In the rubber chemical section there have been decreases in the prices of lithopone and sulphur, and a number of changes are reported in wood distillation products. A number of coal tar products have been advanced since last week and there have been a number of price changes in essential oils. Unless otherwise stated the prices below cover fair quantities net and naked at sellers' works.

LONDON.—Chemical merchants in London report that prices remain steady in general and the demand for chemical products is fair.

MANCHESTER.—During the greater part of the week the Manchester chemical market has had a somewhat unsettled appearance as a result of the international uncertainties, but at the moment of writing the tone is rather brighter. There has been a fairly steady movement of supplies of most descriptions of heavy chemical products against contracts, including the varieties used in the textile and allied industries in Lancashire and the West Riding, and the position in this respect so far this month compares favourably with either January or February. New bookings this week have been on moderate lines, with business, as before, largely concerned with early delivery dates. Steady to firm price conditions continue in evidence, more especially in the market for by-products, where the easy tendency recently in evidence in one or two sections appears to have come to an end.

SCOTLAND.—There has been a further slight improvement in the demand for chemicals for home trade during the week, and rather more inquiry for export. Prices generally continue firm at about previous figures with no changes of importance to report.

General Chemicals

ACETONE.—LONDON: £62 to £65 per ton; SCOTLAND: £66 to £68 ex wharf, according to quantity.

ACID, ACETIC.—40% technical, £16 12s. 6d. per ton. LONDON: Tech., 80%, £30 5s. to £32 5s. per ton; pure 80%, £32 5s. to £34 5s.; tech., 40%, £16 12s. 6d. to £18 12s. 6d.; tech., 60%, £23 10s. to £25 10s. SCOTLAND: Glacial 98/100%, £48 to £52; pure 80%, £32 5s.; tech., 80%, £30 5s., d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £30 5s.; tech. glacial, £50.

ACID, BORIC.—Commercial granulated, £27 per ton; crystal, £28; powdered, £29; extra finely powdered, £31; packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. B.P. cryst., £36; B.P. powder, £37. SCOTLAND: Crystals, £28; powdered, £29.

ACID, CHROMIC.—10½d. per lb., less 2½%, d/d U.K.

ACID, CITRIC.—11¾d. per lb. MANCHESTER: 1s. SCOTLAND: 11¾d.

ACID, CRESYLIC.—97/100%, 1s. 5d. to 1s. 6d. per gal.; 99/100%, refined, 1s. 9d. to 1s. 10d. per gal. LONDON: 98/100%, 1s. 5d. f.o.r.; dark, 1s.

ACID, FORMIC.—LONDON: £42 to £47 per ton.

ACID, HYDROCHLORIC.—Spot, 4s. to 6s. carboy d/d according to purity, strength and locality. SCOTLAND: Arsenical quality, 4s.; dearsenicated, 5s. ex works, full wagon loads.

ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £50; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £55; edible, 50% by vol., £41. One-ton lots ex works, barrels free.

ACID, NITRIC.—80° Tw. spot, £18 to £25 per ton makers' works. SCOTLAND: 80°, £24 ex station full truck loads.

ACID, OXALIC.—LONDON: £47 17s. 6d. to £57 10s. per ton, according to packages and position. SCOTLAND: 98/100%, £48 to £50 ex store. MANCHESTER: £48 10s. to £54 ex store.

ACID, SULPHURIC.—SCOTLAND: 144° quality, £3 12s. 6d.; 168°, £7; dearsenicated, 20s. per ton extra.

ACID, TARTARIC.—1s. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. LONDON: 11½d., less 5%. SCOTLAND: 1s. 0¼d. less 5%. MANCHESTER: 1s. per lb.

ALUM.—SCOTLAND: Lump potash, £8 10s. per ton ex store.

ALUMINA SULPHATE.—LONDON: £7 10s. to £8 per ton. SCOTLAND: £7 to £8 ex store.

AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.

AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.

AMMONIUM BICHROMATE.—8d. per lb. d/d U.K.

AMMONIUM CARBONATE.—SCOTLAND: Lump, £30 per ton; powdered, £33, in 5-cwt. casks d/d buyers' premises U.K.

AMMONIUM CHLORIDE.—LONDON: Fine white crystals, £18 to £19. (See also Salammoniac.)

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

AMMONIUM SULPHATE.—Neutral quality, 20.6% nitrogen, £7 per ton.

ANTIMONY OXIDE.—SCOTLAND: £61 to £65 per ton, c.i.f. U.K. ports.

ANTIMONY SULPHIDE.—Golden, 6½d. to 1s. 1d. per lb.; crimson, 1s. 5½d. to 1s. 7d. per lb., according to quality.

ARSENIC.—LONDON: £15 per ton c.i.f. main U.K. ports for imported material; Cornish nominal, £22 10s. f.o.r. mines. SCOTLAND: White powdered, £23 ex wharf. MANCHESTER: White powdered Cornish, £21, ex store.

ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.

BARIUM CHLORIDE.—LONDON: £10 10s. per ton. SCOTLAND: £10 10s. to £10 15s.

BARYTES.—£6 10s. to £8 per ton.

BISULPHITE OF LIME.—£6 10s. per ton f.o.r. London.

BLEACHING POWDER.—Spot, 35/37%, £7 19s. per ton d/d station in casks, special terms for contract. SCOTLAND: £9 5s.

BORAX, COMMERCIAL.—Granulated, £14 10s. per ton; crystal, £15 10s.; powdered, £16; finely powdered, £17; packed in 1-cwt. bags, carriage paid home to buyer's premises within the United Kingdom in 1-ton lots.

CADMIUM SULPHIDE.—5s. 3d. to 5s. 6d. per lb.

CALCIUM CHLORIDE.—Solid 70/75% spot, £5 5s. per ton d/d station in drums.

CARBON BISULPHIDE.—£31 to £33 per ton, drums extra.

CARBON BLACK.—3¾d. to 4⅞d. per lb. LONDON: 4½d. to 5d.

CARBON TETRACHLORIDE.—SCOTLAND: £41 to £43 per ton, drums extra.

CHROMIUM OXIDE.—10¾d. per lb., according to quantity d/d U.K.; green, 1s. 2d. per lb.

CHROMETAN.—Crystals, 2⅝d. per lb.; liquor, £19 10s. per ton d/d

COPPERAS (GREEN).—SCOTLAND: £3 15s. per ton, f.o.r. or ex works.

CREAM OF TARTAR.—£3 19s. per cwt. less 2½%. LONDON: £3 17s. per cwt. SCOTLAND: £3 16s. 6d. net.

DINITROTOLUENE.—66/68° C., 9d. per lb.

DIPHENYLGUANIDINE.—2s. 2d. per lb.

FORMALDEHYDE.—LONDON: £24 10s. per ton. SCOTLAND: 40%, £25 to £28 ex store.

IODINE.—Resublimed B.P., 6s. 3d. to 8s. 4d. per lb.

LAMPBLACK.—£45 to £48 per ton.

LEAD ACETATE.—LONDON: White, £36 10s. per ton; brown, £1 per ton less. SCOTLAND: White crystals, £34 to £35; brown, £1 per ton less. MANCHESTER: White, £36; brown, £35.

LEAD NITRATE.—£32 10s. to £34 10s. per ton.

LEAD, RED.—SCOTLAND: £25 to £27 per ton less 2½%; d/d buyer's works.

LEAD, WHITE.—SCOTLAND: £39 per ton, carriage paid. LONDON: £41.

LITHOPONE.—30%, £16 5s. to £16 10s. per ton.

MAGNESITE.—SCOTLAND: Ground calcined, £9 per ton, ex store.

MAGNESIUM CHLORIDE.—SCOTLAND: £7 per ton.

MAGNESIUM SULPHATE.—Commercial, £5 per ton, ex wharf.

METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

PHENOL.—6¾d. to 7½d. per lb. to June 30, 1936.

POTASH, CAUSTIC.—LONDON: £42 per ton. MANCHESTER: £39.

POTASSIUM BICHROMATE.—Crystals and Granular, 5d. per lb. less 5%, d/d U.K. Ground, 5½d. LONDON: 5d. per lb. less 5%, with discounts for contracts. SCOTLAND: 5d. d/d U.K. or c.i.f. Irish Ports. MANCHESTER: 5d.

POTASSIUM CHLORATE.—LONDON: £37 to £40 per ton. SCOTLAND: 99¾/100%, powder, £37. MANCHESTER: £38.

POTASSIUM CHROMATE.—6½d. per lb. d/d U.K.

POTASSIUM IODIDE.—B.P., 5s. 2d. per lb.

POTASSIUM NITRATE.—SCOTLAND: Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 8¾d. per lb. SCOTLAND: B.P. crystals, 10d. to 10½d. MANCHESTER: B.P., 11d. to 11½d.

POTASSIUM PRUSSIATE.—LONDON: Yellow, 8½d. to 8¾d. per lb. SCOTLAND: Yellow spot, 8½d. ex store. MANCHESTER: Yellow, 8½d.

SALAMMONIAC.—First lump spot, £41 17s. 6d. per ton d/d in barrels. SCOTLAND: Large crystals, in casks, £36.

SODA ASH.—58% spot, £5 12s. 6d. per ton f.o.r. in bags.

SODA, CAUSTIC.—Solid, 76/77° spot, £13 17s. 6d. per ton d/d station. SCOTLAND: Powdered 98/99%, £17 10s. in drums, £18 5s. in casks, Solid 76/77°, £14 12s. 6d. in drums; 70/73%, £14 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less. MANCHESTER: £13 5s. to £14 contracts.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE.—LONDON: £21 per ton. SCOTLAND: £20 15s.

SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags. SCOTLAND: Refined recrystallised £10 15s. ex quay or station. MANCHESTER: £10 10s.

Sodium Bichromate.—Crystals cake and powder 4d. per lb. net d/d U.K. discount 5%. Anhydrous, 5d. per lb. **London**: 4d. per lb. less 5% for spot lots and 4d. per lb. with discounts for contract quantities. **Manchester**: 4d. per lb. basis. **Scotland**: 4d. delivered buyer's premises with concession for contracts.

Sodium Bisulphite Powder.—60/62%, £20 per ton d/d 1 cwt. iron drums for home trade.

Sodium Carbonate, Monohydrate.—£15 per ton d/d in minimum ton lots in 2 cwt. free bags. Soda crystals, **Scotland**: £5 to £5 5s. per ton ex quay or station. Powdered or pea quality, 7s. 6d. per ton extra. Light Soda Ash, £7 ex quay, min. 4-ton lots with reductions for contracts.

Sodium Chlorate.—£30 per ton. **Scotland**: 3¾d. per lb.

Sodium Chromate.—4d. per lb. d/d U.K.

Sodium Hyposulphite.—**Scotland**: Large crystals English manufacture, £9 5s. per ton ex stations, min. 4-ton lots. Pea crystals, £14 10s. ex station, 4-ton lots. **Manchester**: Commercial, £10 5s.; photographic, £14 10s.

Sodium Metasilicate.—£14 per ton, d/d U.K. in cwt. bags.

Sodium Iodide.—B.P., 6s. per lb.

Sodium Nitrite.—**London**: Spot, £18 5s. to £20 5s. per ton d/d station in drums.

Sodium Perborate.—10%, 9¾d. per lb. d/d in 1-cwt. drums. **London**: 10d. per lb.

Sodium Phosphate.—£13 per ton.

Sodium Prussiate.—**London**: 5d. to 5½d. per lb. **Scotland**: 5d. to 5¾d. ex store. **Manchester**: 5d. to 5½d.

Sodium Silicate.—140° Tw. Spot, £8 per ton. **Scotland**: £8 10s.

Sodium Sulphate (Glauber Salts).—£4 2s. 6d. per ton d/d **Scotland**: English material, £3 15s.

Sodium Sulphate (Salt Cake).—Unground spot, £3 12s. 6d. per ton d/d station in bulk. **Scotland**: Ground quality, £3 5s. per ton d/d. **Manchester**: £3 2s. 6d. to £3 5s.

Sodium Sulphide.—Solid 60/62% Spot, £10 15s. per ton d/d in drums; crystals 30/32%, £8 per ton d/d in casks. **Scotland**: For home consumption, Solid 60/62%, £10 5s.; broken 60/62%, £11 5s.; crystals, 30/32%, £8 7s. 6d., d/d buyer's works on contract, min. 4-ton lots. Spot solid, 5s. per ton extra. Crystals, 2s. 6d. per ton extra. **Manchester**: Concentrated solid, 60/62%, £11; commercial, £8 2s. 6d.

Sodium Sulphite.—Pea crystals, spot, £13 10s. per ton d/d station in kegs. Commercial spot, £8 15s. d/d station in bags.

Sulphur.—£9 5s. to £9 15s. per ton. **Scotland**: £8 to £9.

Sulphate of Copper.—**Manchester**: £14 17s. 6d. per ton f.o.b.

Sulphur Chloride.—5d. to 7d. per lb., according to quality.

Sulphur Precip.—B.P., £55 to £60 per ton according to quantity. Commercial, £50 to £55.

Vermilion.—Pale or deep, 5s. 1d. per lb. in 1-cwt. lots.

Zinc Chloride.—**Scotland**: British material, 98%, £18 10s. per ton f.o.b. U.K. ports.

Zinc Sulphate.—**London**: £12 per ton. **Scotland**: £10 10s.

Zinc Sulphide.—10d. to 11d. per lb.

Nitrogen Fertilisers

Sulphate of Ammonia.—£7 5s. per ton for neutral quality basis 20.6% nitrogen delivered in 6-ton lots to farmer's nearest station.

Calcium Cyanamide.—March, £7 3s. 9d. per ton; April/June, £7 5s., delivered in 4-ton lots.

Nitro-Chalk.—£7 5s. per ton delivered in 6-ton lots to farmer's nearest station.

Nitrate of Soda.—£7 12s. 6d. per ton delivered in 6-ton lots to farmer's nearest station.

Concentrated Complete Fertilisers.—£10 10s. to £10 19s. per ton according to analysis, delivered in 6-ton lots to farmer's nearest station.

Ammonium Phosphate (N.P.) Fertilisers.—£10 5s. to £13 15s. per ton according to analysis, delivered in 6-ton lots to farmer's nearest station.

Coal Tar Products

Acid, Cresylic.—99/100%, 2s. 1d. to 3s. per gal., according to specification; pale 98%, 1s. 10d. to 2s.; dark, 1s. 6d. to 1s. 7d. **London**: 98/100%, 1s. 4d.; dark, 95/97%, 1s. **Scotland**: Pale, 99/100%, 1s. 3d. to 1s. 4d.; dark, 97/99%, 1s. to 1s 1d.; high boiling acid, 2s. 6d. to 3s.

Acid, Carbolic.—Crystals, 6¾d. to 7½d. per lb.; crude, 60's, 2s. 3d. to 2s. 5d. per gal. **Manchester**: Crystals, 7¼d. per lb.; crude, 2s. 1d. per gal. **Scotland**: 60's, 2s. 6d. to 2s. 7d.

Benzol.—At works, crude, 8½d. to 9d. per gal.; standard motor 1s. 2d. to 1s. 2½d.; 90%, 1s. 3d. to 1s. 3½d.; pure, 1s. 7d. to 1s. 7½d. **London**: Motor, 1s 3½d. **Scotland**: Motor, 1s. 6½d.

Creosote.—B.S.I. Specification standard, 5½d. per gal. f.o.r. Home, 3¾d. d/d. **London**: 4½d. f.o.r. North; 5d. London. **Manchester**: 4½d. to 5¼d. **Scotland**: Specification oils, 4d.; washed oil, 4¼d. to 4¾d.; light, 4½d.; heavy, 4¼d. to 4½d.

Naphtha.—Solvent, 90/100%, 1s. 5½d. to 1s. 6½d. per gal.; 95/160%, 1s. 9d.; 90%, 1s. to 1s. 2d. **London**: Solvent, 1s. 3½d. to 1s. 4d.; heavy, 11d. to 1s. 0½d. f.o.r. **Scotland**: 90/160%, 1s. 3d. to 1s. 3½d.; 90/190%, 11d. to 1s. 2d.

Naphthalene.—Crude, whizzed or hot pressed, £17 10s. per ton; purified crystals, £24 to £25 per ton in 2-cwt. bags. **London**: Fire lighter quality, £3 to £3 10s.; 74/76 quality, £4 to £4 10s.; 76/78 quality, £5 10s. to £6. **Scotland**: 40s. to 50s.; whizzed, 70s. to 75s.

Pyridine.—90/140%, 5s. 3d. to 7s. 6d. per gal.; 90/180, 2s. 3d.

Toluol.—90%, 2s. 3d. per gal.; pure, 2s. 7d.

Xylol.—Commercial, 2s. 3d. per gal.; pure, 2s. 5d.

Pitch.—Medium, soft, 42s. 6d. to 43s. per ton, in bulk at makers' works. **Manchester**: 40s. f.o.b., East Coast.

Wood Distillation Products

Acetate of Lime.—Brown, £7 15s. to £8 10s. per ton; grey, £10 10s. to £11. Liquor, brown, 30° Tw., 8d. per gal. **Manchester**: Brown, £9 10s.; grey, £11.

Charcoal.—£5 to £10 per ton, according to grade and locality.

Methyl Acetone.—40-50%, £46 to £50 per ton.

Wood Creosote.—Unrefined, 6d. to 1s. 3d. per gal.

Wood Naphtha, Miscible.—2s. 6d. to 3s. 3d. per gal.; solvent, 3s. to 4s. per gal.

Wood Tar.—£2 to £2 10s. per ton.

Intermediates and Dyes

Acid, Benzoic, 1914 B.P. (ex Toluol).—1s. 9½d. per lb.

Acid, Gamma.—Spot, 4s. per lb. 100% d/d buyer's works.

Acid, H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.

Acid Naphthionic.—1s. 8d. per lb.

Acid, Neville and Winther.—Spot, 3s. per lb. 100%.

Acid, Sulphanilic.—Spot, 8d. per lb. 100%, d/d buyer's works.

Aniline Oil.—Spot, 8d. per lb., drums extra, d/d buyer's works.

Aniline Salts.—Spot, 8d. per lb. d/d buyer's works, casks free.

Benzaldehyde.—Spot, 1s. 8d. per lb., packages extra.

Benzidine Base.—Spot, 2s. 5d. per lb., 100% d/d buyer's works.

Benzidine HCL.—2s. 5d. per lb.

***o*-Cresol** 30/31° C.—6d. per lb. in 1-ton lots.

***p*-Cresol** 34-5° C.—1s. 6d. per lb. in ton lots.

***m*-Cresol** 98/100%.—1s. 7d. per lb. in ton lots.

Dichloraniline.—1s. 11¼d. to 2s. 3d. per lb.

Dimethylaniline.—Spot, 1s. 6d. per lb., package extra.

Dinitrobenzene.—8d. per lb.

Dinitrotoluene.—48/50° C., 9d. per lb.; 66/68° C., 10½d.

Dinitrochlorbenzene, Solid.—£72 per ton.

Diphenylamine.—Spot, 2s. per lb., d/d buyer's works.

α-Naphthol.—Spot, 2s. 4d. per lb., d/d buyer's works.

β-Naphthol.—Spot, £78 15s. per ton, in paper bags.

α-Naphthylamine.—Spot, 11½d. per ton., d/d buyer's works.

β-Naphthylamine.—Spot, 2s. 9d. per lb., d/d buyer's works.

***o*-Nitraniline.**—3s. 11d. per lb.

***m*-Nitraniline.**—Spot, 2s. 7d. per lb., d/d buyer's works.

***p*-Nitraniline.**—Spot, 1s. 8d. per lb., d/d buyer's works.

Nitrobenzene.—Spot, 4½d. to 5d. per lb.; 5-cwt. lots, drums extra.

Nitronaphthalene.—9d. per lb.; P.G., 1s. 0½d. per lb.

Sodium Naphthionate.—Spot, 1s. 9d. per lb.

***o*-Toluidine.**—9½d. to 11d. per lb.

***p*-Toluidine.**—1s. 11d. per lb.

Essential Oils

Anise.—2s. 6d. per lb.

Bergamot.—10s. 6d. per lb.

Bourbon Geranium.—24s. per lb.

Cassia.—80/85%, 4s. 9d. per lb.

Citronella Oil, Ceylon.—1s. per lb.

Clove, 90/92%, English.—4s. 9d. per lb.

Lavender, Mont Blanc.—38/40%, 23s. 6d. per lb.

Otto of Rose, Anatolian.—37s. 6d. per oz.; Bulgarian: 48s. 6d.

Palma Rosa.—6s. 9d. per lb.

Peppermint, Japanese.—6s. 6d. per lb.; Wayne County: 9s. 6d.

Latest Oil Prices

London, March 18.—**Linseed Oil** was quiet. Spot, £28 10s. per ton (small quantities), April, £26 2s. 6d.; May-Aug., £26 5s.; Sept.-Dec., £26 7s. 6d., naked. **Soya Bean Oil** was steady. Oriental (bulk), March shipment, £21 15s. per ton. **Rape Oil** was quiet. Crude extracted, £34 10s. per ton; technical refined, £36, naked, ex wharf. **Cotton Oil** was steady. Egyptian crude, £24 10s. per ton; refined common edible, £28, and deodorised, £30, naked, ex mill (small lots £1 10s. extra). **Turpentine** was dearer, American, spot, 43s. 3d. per cwt.

Hull.—**Linseed Oil**, spot, quoted £26 7s. 6d. per ton. March, £25 17s. 6d.; April, £26; May-Aug., £26 2s. 6d.; Sept.-Dec., £26 5s. **Palm Kernel Oil**, crude, f.m.q., spot, £23 10s., naked. **Cotton Oil**, Egyptian, crude, spot, £25; edible, refined, spot, £27 10s.; technical, spot, £27 10s.; deodorised, £29 10s., naked. **Groundnut Oil**, extracted, spot, £30 10s.; deodorised, £33 10s. **Rape Oil**, extracted, spot, £33 10s.; refined, £35. **Soya Oil**, extracted, spot, £26; deodorised, £29 per ton. **Cod Oil**, f.o.r., or f.a.s., 25s. per cwt., in barrels. **Castor Oil**, pharmaceutical, 42s. 6d. per cwt.; firsts, 37s. 6d.; seconds, 35s. 6d. **Turpentine**, American, spot, 44s. 3d. per cwt.

Chemical and Allied Stocks and Shares

THE more hopeful views current with regard to the European political situation this week have led to a fairly general recovery in industrial shares from their recent decline. In many cases prices are still a good deal below those ruling a fortnight or so ago, but the disposition in the market is to expect that before long there may be a strong upward movement. Among companies associated with the chemical and allied trades Pinchin Johnson were active on the advance in profits and the increase in the dividend from 17½ per cent. to 20 per cent. and shares of other paint companies also tended to come in for rather more attention, particularly International Paint which remained under the influence of the larger profits and dividend recently shown in the report. Lewis Berger are still well below the price ruling a week ago, but are very firm, there being growing anticipations in the market that a larger interim dividend is in prospect. Blythe Colour Works were again active, although these 4s. shares are somewhat lower on balance at 11s. 9d. Imperial Chemical have held up well as have Imperial Smelting. The latter were aided by rumours that over the next few months there may be steps to re-institute the zinc cartel and that if this is correct it might be an important influence in making for a higher price for zinc, on which the Corporation's profits depend in a large measure. Salt Union have been rather depressed on the statement in the recently issued report concerning competition from foreign salt. Although profits are lower the dividend of Cooper, McDougall and Robertson is maintained at 7½ per cent. and a strong balance sheet position is again shown. The directors state in their report that it has been considered advisable to revise trading arrangements in certain countries, with the result that the bringing to the credit of profit and loss account of the major proportion of the profits normally accruing from trading in these countries has been deferred to the succeeding year. This charge only affects the results for the past year, and future profits are expected to benefit from this revision. Monsanto Chemicals' 5½ per cent. preference were again more active, but are slightly lower on balance at around 23s. Lawes Chemical were around 8s. 9d. and British Drug Houses kept at 21s. 3d. There has been more activity in Burt, Boulton and Haywood than for a long time past and a rise of 1s. 3d. to 21s. 3d. despite the fact that the price went "ex" the larger interim dividend on Monday. British Cotton and Wool Dyers were steady, but most of the cotton textile shares and those of rayon companies have remained dull and are moderately lower in various cases. Courtaulds failed to attract any large expansion of business despite the fact that they have kept around 51s., but the view persists in the market that a good recovery is likely when there is a strong general advance in leading industrial shares. Fison, Packard and Prentice have made a rather lower price. British Cyanides are virtually unchanged on balance for the week. The 3s. shares of William Blythe held up well around 8s. and United Premier Oil and Cake, another share which continues to be the subject of good dividend expectations in the market, were also quite well maintained, as was Goodlass Wall and Lead Industries. Favourable reports from the north-east coast and other centres of the heavy industries, combined with the good dividend announcements of Baldwins, Hadfields and Thos. Firth and John Brown, were among the factors which attracted more attention to leading iron and steel shares. Consett Iron and Dorman Long issues are inclined to make higher prices at the time of writing. International Nickel of Canada common shares have transferred very actively, largely owing to the excellent results for the past year, which both as regards sales and profits show figures exceeding those of 1929 which was hitherto the company's peak year. The report contains encouraging views indicating that the demand for nickel is likely to continue on the up grade. Borax Consolidated have been fairly steady as were British Glues and Chemicals, the last named having continued to benefit from anticipations that dividends will be resumed this year. Associated Portland Cement have again been very firm awaiting the full results for the past year. Unilever are moderately lower, partly owing to the diminishing hopes of a larger dividend as it is being feared the complicated political conditions on the Continent may lead the directors to follow a conservative policy in the matter of dividend. Lever Brothers preference were also somewhat lower, although forthcoming results are likely to show that profits have been quite well maintained.

Name.	March 17.	March 10.
Anglo-Iranian Oil Co., Ltd. Ord.	90/7½	91/10½
,, 8% Cum. Pref.	36/3	36/9
,, 9% Cum. Pref.	37/-	37/9
Associated Dyers and Cleaners, Ltd. Ord.	1/10½	1/10½
,, 6½% Cum. Pref.	6/6¾	6/3
Associated Portland Cement Manufacturers, Ltd. Ord.	86/3	85/7½
,, 5½% Cum. Pref.	27/-	28/-
Benzol & By-Products, Ltd. 6% Cum. Part. Pref.	3/9	3/9
Berger (Lewis) & Sons, Ltd. Ord.	67/6	69/4½
Bleachers' Association, Ltd. Ord.	6/3	6/3
,, 5½% Cum. Pref.	10/7½	11/3
Boake, A., Roberts & Co., Ltd. 5% Pref. (Cum.)	20/-	20/-
Boots Pure Drug Co., Ltd. Ord. (5/-)	55/-	56/6
Borax Consolidated, Ltd. Pfd. Ord. (£)	112/6	112/6
,, Defd. Ord.	27/6	28/9
,, 5½% Cum. Pref. (£10)	£12/5/-	£11/15/-
,, 4½% Deb. (1st Mort.) Red. (£100)	£107/10/-	£107/10/-
,, 4½% 2nd Mort. Deb. Red. (£100)	£105/10/-	£105/10/-
Bradford Dyers' Association, Ltd. Ord.	8/9	8/1½
,, 5% Cum. Pref.	11/3	10/7½
,, 4% 1st Mort. Perp. Deb. (£100)	£86/10/-	£86/10/-
British Celanese, Ltd. 7% 1st Cum. Pfd.	24/9	25/-
,, 7½% Part. 2nd Cum. Pref.	21/-	21/3
British Cotton & Wool Dyers' Association Ltd. Ord. (5/-)	6/-	6/3
,, 4% 1st Mort. Deb. Red. (£100)	£97	£97
British Cyanides Co., Ltd. Ord. (2/-)	4/3	4/3
British Drug Houses, Ltd. Ord.	21/3	21/3
,, 5% Cum. Pref.	21/10½	21/10½
British Glues and Chemicals, Ltd. Ord. (4/-)	8/-	8/1½
,, 8% Pref. (Cum. and Part.)	29/4½	30/-
British Oil and Cake Mills, Ltd. Cum. Pfd. Ord.	47/10½	49/4½
,, 5½% Cum. Pref.	26/3	25/7½
,, 4¼% First Mort. Deb. Red. (£100)	£107/10/-	£107/10/-
British Oxygen Co., Ltd. Ord.	91/3	92/6
,, 6½% Cum. Pref.	32/6	32/6
British Portland Cement Manufacturers, Ltd. Ord.	87/6	87/6
,, 6% Cum. Pref.	28/9	28/9
Bryant & May, Ltd. Pref.	67/6	67/6
Burt, Boulton & Haywood, Ltd. Ord.	21/3	20/-
,, 7% Cum. Pref.	28/9	27/6
,, 6% 1st Mort. Deb. Red. (£100)	£102/10/-	£102/10/-
Bush, W. J., & Co., Ltd. 5% Cum. Pref. (£5)	112/6	112/6
,, 4% 1st Mort. Deb. Red. (£100)	£96/10/-	£96/10/-
Calico Printers' Association, Ltd. Ord.	8/1½	8/1½
,, 5% Pref. (Cum.)	11/3	11/3
Cellulose Acetate Silk Co., Ltd. Ord.	12/2¼	12/10
,, Deferred (1/-)	2/1½	2/4½
Consett Iron Co., Ltd. Ord.	13/-	13/3
,, 8% Pref.	37/6	37/6
,, 6% First Deb. stock, Red. (£100)	£110/10/-	£110/10/-
Cooper, McDougal & Robertson, Ltd. Ord.	35/-	37/6
,, 7% Cum. Pref.	28/9	30/-
Courtaulds, Ltd. Ord.	51/3	51/7
,, 5% Cum.	25/9	25/7½
Crosfield, Joseph, & Sons, Ltd. 5% Cum. Pre-Pref.	25/-	25/-
,, Cum. 6% Pref.	28/1½	28/9
,, 6½% Cum. Pref.	31/3	31/10½
,, 7½% "A" Cum. Pref.	32/6	32/6
Distillers Co., Ltd. Ord.	99/9	99/-
,, 6% Pref. Stock Cum.	30/-	32/-
Dorman Long & Co., Ltd. Ord.	28/1½	28/9
,, Pref. Ord.	41/3	42/6
,, 6½% Non-Cum. 1st Pref.	24/6	25/3
,, 8% Non-Cum. 2nd Pref.	25/9	25/7½
,, 4% First Mort. Perp. Deb. (£100)	£103/10/-	£103/10/-
,, 5% 1st Mort. Red. Deb. (£100)	£105/10/-	£105/10/-
English Velvet & Cord Dyers' Association Ltd. Ord.	3/9	3/9
,, 5% Cum. Pref.	7/6	7/6
,, 4% First Mort. Deb. Red. (£100)	£68	£70/10/-
Fison, Packard & Prentice, Ltd. Ord.	43/9	45/7½
,, 7% Non-Cum. Pref.	31/10½	31/10½
,, 4½% Debs. (Reg.) Red. (£100)	£106	£106
Gas Light and Coke Co.	27/9	28/-
,, 3½% Maximum Stock (£100)	£90/10/-	£90/10/-
,, 4% Consolidated Pref. Stock (£100)	£108/10/-	£108/10/-
,, 3% Consolidated Deb. Stock, Irred. (£100)	£90/10/-	£91/10/-
,, 5% Deb. Stock Red. (£100)	£118/10/-	£118/10/-
,, 4½% Red. Deb. Stock (1960-65) (£100)	£115/10/-	£115/10/-
Goodlass Wall & Lead Industries, Ltd. Ord. (10/-)	15/7½	15/7½
,, 7% Prefd. Ord. (10/-)	13/9	13/9
,, 7% Cum. Pref.	30/-	30/-

Name.	March 17.	March 10.
Gossage, William, & Sons, Ltd. 5% 1st Cum. Pref.	24/4½	24/4½
,, 6½% Cum. Pref.	28/9	30/-
Imperial Chemical Industries, Ltd. Ord.	39/-	39/9
,, Deferred (10/-)	9/7½	9/7½
,, 7% Cum. Pref.	33/9	34/-
Imperial Smelting Corporation, Ltd. Ord.	17/6	17/9
,, 6½% Pref. (Cum.)	25/7½	25/7½
International Nickel Co. of Canada, Ltd. Cum.	$50¼	$50
Johnson, Matthey & Co., Ltd. 5% Cum. Pref. (£5)	105/-	105/-
,, 4% Mort. Deb. Red. (£100)	£98/10/-	£98/10/-
Laporte, B., Ltd. Ord.	120/-	122/6
Lawes Chemical Co., Ltd. Ord. (1/-)	8/9	8/9
,, 7% Non-Cum. Part Pref. (10/-)	10/-	10/-
Lever Bros., Ltd. 7% Cum. Pref.	31/-	32/-
,, 8% Cum. "A" Pref.	32/-	33/-
,, 20% Cum. Prefd. Ord.	79/4½	79/4½
,, 5% Cons. Deb. (£100)	£105/10/-	£108/10/-
,, 4% Cons. Deb. (£100)	£104/10/-	£106/10/-
Magadi Soda Co., Ltd. 12½% Pref. Ord. (5/-)	1/3	1/3
,, 6% 2nd Pref. (5/-)	6d.	6d.
,, 6% 1st Debs. (Reg.)	£40	£41
Major & Co., Ltd. Ord. (5/-)	7½d.	7½d.
,, 8% Part. Prefd. Ord. (10/-)	9d.	9d.
,, 7½% Cum. Pref.	1/6¾	1/6¾

Name.	March 17.	March 10.
Pinchin, Johnson & Co., Ltd. Ord. (10/-)	45/-	45/6
,, 1st Pref. 6½% Cum.	32/-	32/-
Potash Syndicate of Germany (Deutsches Kalisyndikat G.m.b.H.) 7% Gld. Ln. Sr. "A" and "B" Rd.	£70/10/-	£72
Reckitt & oSns, Ltd. Ord.	115/-	115/-
,, 4½% Cum. 1st Pref.	24/4½	24/4½
Salt Union, Ltd. Ord.	43/9	45/-
,, Pref.	48/1½	47/6
,, 4½% Deb. (£100)	£107/10/-	£107/10/-
South Metropolitan Gas Co. Ord. (£100)	£122/10/-	£125/10/-
,, 6% Irred. Pref. (£100)	£149/10/-	£149/10/-
,, 4% Pref. (Irred.) (£100)	£105	£105
,, Perpetual 3% Deb. (£100)	£89/10/-	£89/10/-
,, 5% Red. Deb. 1950-60 (£100)	£115/10/-	£115/10/-
Staveley Coal and Iron Co., Ltd. Ord.	50/-	50/7½
Stevenson & Howell, Ltd. 6½% Cum. Pref.	26/3	26/3
Triplex Safety Glass Co., Ltd. Ord. (10/-)	88/9	87/6
Unilever, Ltd. Ord.	31/3	32/6
,, 7% Cum. Pref.	30/3	30/3
United Glass Bottle Manufacturers, Ltd. Ord.	45/-	45/-
,, 7½% Cum. Pref.	32/6	32/6
United Molasses Co., Ltd. Ord. (6/8)	23/9	25/-
,, 6% Cum. Pref.	26/3	26/3
United Premier Oil & Cake Co., Ltd. Ord. (5/-)	12/6	12/6
,, 7% Cum. Pref.	25/-	25/7½
,, 4¾% Deb. Red. (£100)	£104	£104

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications Open to Public Inspection

Carboxylic acids and their salts, manufacture.—Imperial Chemical Industries, Ltd. Aug. 27, 1934. 36847/34.

Diethylaminoethanol.—Carbide and Carbon Chemicals Corporation. Aug. 25, 1934. 18656/35.

Process for delustering lustrous fibrous materials.—Böhme Fettchemie-Ges. Aug. 28, 1934. 20304/35.

Polyvinyl acetal resins.—Carbide and Carbon Chemicals Corporation. Aug. 29, 1934. 20347/35.

Dyeing of fibrous materials.—Böhme Fettchemie-Ges. Aug. 28, 1934. 20651/35.

Aromatic compounds containing selenium, nitrogen and sulphur, process for production.—E. Theobald and P. Theobald. Aug. 30, 1934. 23099/35.

Calcium aluminate suitable for the manufacture of sodium aluminate by treatment with sodium lye, process for production.—Aktieselskapet Norsk Aluminium Co. Aug. 30, 1934. 23414/35.

Dyeing of textiles.—I. G. Farbenindustrie. Aug. 25, 1934. 23733/35.

Reduction of metal-oxygen compounds.—F. Uhde. Aug. 28, 1934. 23881/35.

Pectin, and method of preparing same.—General Foods Corporation. Aug. 28, 1934. 24072/35.

Anthraquinone derivatives, process for manufacture.—I. G. Farbenindustrie. Aug. 29, 1934. 24191/35.

Specifications Accepted with Date of Application

Pure phenols from lignite tar, shale tar, and low-temperature tars, method for production.—J. Meyer. Dec. 14, 1934. 443,285.

Compositions for setting animal fibres such as wool or hair.—Imperial Chemical Industries, Ltd., H. A. Piggott and J. B. Speakman. June 20,1934. 443,359.

Alkali metal addition products of aromatic hydrocarbons, manufacture.—Imperial Chemical Industries, Ltd. (E. I. Du Pont de Nemours and Co.). June 26, 1934. 443,361.

Esters of 2-butyloctanol.—Carbide and Carbon Chemicals Corporation. May 11, 1934. 442,643.

Removal of sulphur compounds from gases.—Gas Light and Coke Co., W. K. Hutchison and G. U. Hopton. May 18, 1934. 443,094.

Cleaning or descaling metal, process.—U. C. Tainton. July 7, 1934. 442,859.

Nitrogenous derivatives of di-benzanthrone, manufacture and production.—Coutts and Co. and F. Johnson (legal representatives of J. Y. Johnson (deceased)) (I. G. Farbenindustrie). July 10, 1934. 442,860.

Impregnation of articles with solutions in volatile distillable solvents.—General Engineering Co. (Radcliffe), Ltd., S. Taylor and R. Johnson. Aug. 11, 1934. 442,866.

Organic acid anhydrides, manufacture.—W. W. Groves (Akt.-Ges. für Stickstoffdünger). Aug. 14, 1934. 443,151.

Substituted aromatic amino-compounds, manufacture.—I. G. Farbenindustrie. Aug. 15, 1934. 442,869.

Coating and plastic compositions.—E. I. du Pont de Nemours and Co. Aug. 15, 1933. 442,872.

Azo dyes on the fibre, manufacture.—Imperial Chemical Industries, Ltd. Aug. 15, 1933. 442,873.

Sodium carbonate, manufacture.—H. E. Cocksedge, E. F. Burns and Imperial Chemical Industries, Ltd. Aug. 15, 1934. 443,101.

Applications for Patents

(February 27 to March 4 inclusive.)

Apparatus for treating liquids.—Aluminium Plant and Vessel Co., Ltd. 6055, 6057.

Vulcanisation of rubber.—Belvedere Chemical Co., Ltd. (United States, March 9, '35.) 6151.

Dyeing vegetable, etc., fibres, process.—A. G. Bloxan (Soc. of Chemical Industry in Basle). 6327.

Varnishes, etc.—British Glues and Chemicals, Ltd. 6015.

Colloidised vat dyes.—Calco Chemical Co., Inc. (United States, April 18, '35.) 6283.

New pyrimidine compounds, manufacture.—A. Carpmael (I. G. Farbenindustrie). 6046.

Chlorine derivatives of unsaturated hydrocarbons, manufacture.—O. W. Cass and E. I. du Pont de Nemours and Co. 6089.

Chlorinated hydrocarbons, manufacture.—O. W. Cass and E. I. du Pont de Nemours and Co. 6090, 6091.

Disazo and trisazo dyestuffs.—H. Dean. 3243.

Chlorine derivatives of unsaturated hydrocarbons, manufacture.—E. I. du Pont de Nemours and Co. 6332.

Stabilisation of animal, etc., fats, etc.—E. I. du Pont de Nemours and Co. (United States, March 5, '35.) 6588.

Nitric acid from nitrous gases, production.—H. D. Elkington (Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij). 5949.

Glyoxal-semi-acetals, manufacture.—H. Fischer. (Switzerland, March 2, '35.) 6326.

Aminocarboxylic acids of capillary action, manufacture.—W. W. Groves (I. G. Farbenindustrie). (Aug. 21, '34.) 6155, 6156.

Dyestuffs of the phthalocyanine series, manufacture.—W. W. Groves (I. G. Farbenindustrie). 6157.

Aromatic ortho-hydroxy-carboxylic acids, manufacture.—W. W. Groves (I. G. Farbenindustrie). 6444.

From Week to Week

AFTER INTERVIEWING SIX CANDIDATES for the post of public analyst, Salford Health Committee decided to recommend to the city council Mr. G. H. Walker, of Liverpool.

THE NOMINAL CAPITAL of William Lynd and Co. (1929), Ltd., oil refiners, soap manufacturers, etc., Leeds, has been increased by the addition of £5,000, beyond the registered capital of £30,000. The additional capital is divided into 5,000 6 per cent. preference shares of £1 each.

A LECTURE on "Magnetism and Valency" was given by Professor S. Sugden, of Birkbeck College, London, at University College, Nottingham, on March 11, the occasion being a joint meeting between the University College Physical and Chemical Society and the Midland Section of the Institute of Physics.

ALL SECTIONS of Hawley's (Dyers) Athletic Club, Basford, were represented at a dinner, whist drive and dance held at the Welbeck Hotel, Nottingham. Mr. A. E. Hawley, president of the club, was in the chair. Mr. R. M. Hilder, manager of the Basford works, proposed the toast of "The President and Mrs. Hawley." Prizes were presented by Mrs. D. A. McPherson, wife of the vice-president.

IN A RESOLUTION STRONGLY PROTESTING AGAINST the Government's rearmament policy as outlined in the recent White Paper, the Executive Council of the Chemical Workers' Union contend that such a policy would entail industrial conscription as a prelude to military conscription. The Council urges the Government not to use the Fascist military menace as an excuse for the militarisation of the population of Great Britain, but to strengthen the forces working for peace.

PRESIDING AT THE ANNUAL MEETING of the United Kingdom Temperance and General Provident Institution, held in London on March 18, Sir Ernest J. P. Benn, Bt., said that it is almost a commonplace with speakers upon modern social and political conditions to talk of the world as mad. However that may be, much of the arrangement of public affairs to-day is artificial, unnatural, and, therefore, unreliable. These circumstances add immensely to the difficulties of managing a large fund.

REFERRING TO INCREASING IMPORTS OF ZINC, Brig.-Gen. Sir Henry Page Croft (Cons., Bournemouth) questioned the President of the Board of Trade in the House of Commons on March 17 regarding steps to protect the zinc-smelting industry in the United Kingdom. In reply, Mr. Runciman said it is understood that negotiations for an international agreement among zinc producers are proceeding, and, if these should prove unsuccessful, the Government will keep in mind the needs of the zinc industry in the United Kingdom.

SHAREHOLDERS OF THE GLENBOIG UNION FIRECLAY CO. met on March 11 at Glasgow to consider the purchase offer made by General Refractories, Ltd. The secretary stated that the chairman, Mr. Robert Henderson, explained that the company would remain as a separate entity. It was resolved unanimously to accept the offer "in one form or the other." Shareholders were offered £9 cash per £10 share, or, alternatively, eight 10s. shares in General Refractories, and holders may take partly cash and partly shares.

DEVELOPMENTS IN THE PRODUCTION OF BENZOL are in progress at the Granton Gasworks of Edinburgh Corporation. A new plant is in course of erection for the recovery of oil from coal, and it will be in operation within a few weeks. The progress of the installation was inspected last week by members of the Corporation, who were given this opportunity of making themselves acquainted with one of the largest and most important undertakings of the Corporation. The experiments which have been made may prove of national importance

MOTOR ENGINEERING CIRCLES are interested by the report that a leading Continental firm of chemists has had patent specifications accepted in this countrty for "means for operating combustion engines with liquid gases." It is assumed that liquid oxygen is implied. Hitherto its use for this purpose had been regarded as impossible because it was so unstable. The view has been expressed that if the technical obstacles to its use in motor engines really has been overcome it is an invention of great importance. For one thing all carbon deposits would be avoided.

TWO HUNDRED FIRMS in all parts of England are sending exhibits to the "Science in Industry" exhibition, organised by the Science Society of Worcester Royal Grammar School, to be held at the school on April 2, 3 and 4. Similar exhibitions were held ten and five years ago, but this one will be on a bigger scale. It is designed to illustrate developments that have taken place in the last decade. Aviation, architecture and building, chemical industries, civil engineering, electrical engineering, fuels, metals, printing, photography, tools and scientific instruments will form the main groups. Boys of the school will act as the demonstrators. The general public will be admitted from 6 p.m. to 10 p.m. each day by tickets which can be obtained from Mr. S. Balchin or from Mr. J. Giblin at the school, or from the secretary of Worcester Chamber of Commerce (Mr. Howell Davies).

BRITISH TAR PRODUCTS, LTD., have removed their Sheffield sales office to 418a Glossop Road, Sheffield. Their new telephone number is Sheffield 60078-60079.

THE PYROPHOSPHATE AND CREAM POWDER CO., LTD., has changed its name to Phosphates, Ltd. Owing to the necessity for larger premises the office and factory have been removed to 22 Market Street, S.E.1 (Telephone: Hop 2178).

THE SIR JESSE BOOT FOUNDATION LECTURE was given at the University College, Nottingham, on March 13 by Professor E. C. Dodds, Courtauld Professor of Biochemistry in the University of London, on "The Chemistry of the Ductless Glands." Professor F. S. Kipping, of Nottingham University College, who presided, paid a tribute to the late Lord Trent's achievements.

THE INTERNATIONAL SUPERPHOSPHATE MANUFACTURERS' ASSOCIATION, of Aldwych House, Aldwych, London, W.C.2, have just published a new supplement to "Phosphates and Superphosphate," by A. N. Gray (1931). This supplement gives statistical tables for the years 1929-34 inclusive and is provided with a gummed slip to enable it to be fixed into the original work. The price is 2s., post free.

TO THE EMPLOYERS OF 4,000 CHINA CLAY WORKERS in Devon and Cornwall proposals have been submitted for increases of one penny to one shilling in wage rates, with double time for work on Sundays and holidays other than maintenance work, payment to night workers of six shifts for five worked, and one week's holiday on pay after six months' service and two weeks after twelve months.

MEETINGS of the Institution of Chemical Engineers are in future to be held on the third Wednesday in the month. The only meetings which will not be so held are the opening meeting of the session, which will take place on the second Wednesday in October; the public lecture of the year, which will take place on the fourth Friday in October, and the annual corporate meeting and dinner, which will probably take place on the first Friday in March, 1937.

RECORD GAS SALES in 1935 are reported in the 1936 Year Book of the Newcastle and Gateshead Gas Co. Among new developments during the year was the fitting out of a new laboratory in order to extend the work of testing gas appliances which until recently had been carried out under very cramped conditions. In the new laboratory the testing equipment has been supplemented and improved so that a searching examination into the capabilities of any appliance can be carried out.

MANSFIELD CORPORATION inaugurated a new system in December by which a bulk supply of gas is taken from the Grassmoor Colliery Co.'s coke ovens. Arrangements were made whereby all employees not required at the old gasworks were absorbed, and so unemployment was prevented. One effect of the change-over, however, was that certain men suffered a decrease in wages of 25s. a week or less. Amongst them were the stokers, who were reduced to labourers. The Corporation has now paid to 22 men affected compensation amounting in all to £227. The amount each man received was in accordance with the number of years he had been employed in the gas undertaking and was based upon the plain time rates of the normal working week.

TO REDUCE THE RISK OF AIR ATTACK the British Oxygen Co. has selected a lonely area near Fort William, Inverness-shire, for the first calcium carbide factory to be established in Scotland. The company's other chemical factories are in Manchester, Birmingham, Southampton, Glasgow, Leith, and other industrial centres. When Parliamentary powers are sought for developing a hydro-electric scheme in the Highlands as a preliminary to the production of carbide, one of the reasons given by the promoters for choosing this site will be that it is "the least vulnerable to attacks from the air." If Parliament grants the powers, it is proposed to establish the first national chemical factory of its kind as an industry which will make this country independent of foreign sources of an essential war material.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

Lithuania.—H.M. Consul at Kovno reports that the Lithuanian Railway Administration is calling for tenders, to be presented in Lithuania by March 25, 1936, for the supply of 10,000 kilogrammes of Babbit metal. (Ref. T.Y. 5807.)

Argentina.—The Commercial Counsellor to H.M. Embassy at Buenos Aires reports that the Argentine State Oilfields Directorate is calling for tenders, to be presented in Buenos Aires by April 14, 1936, for the supply of 20,000 metres of 1½ in. and 5,000 metres of 2½ in. seamless special piping, steel fittings and brass needle, check and globe valves. (Ref. T.Y. 5791.)

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

(NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt as specified in the last available Annual Summary, is also given marked with an *—followed by the date of the Summary, but such total may have been reduced.)

DURION, LTD., London, S.W., electro-chemical engineers. (M., 21/3/36.) Registered March 6, £500 debentures, part of £3,000 (not exceeded) already registered.

J. J. RIGBY, LTD., Salford, manufacturers of oils, etc. (M., 21/3/36.) Registered March 4, £1,000 debenture to Branch Nominees, Ltd., 15 Bishopsgate, E.C.; general charge.

L. LIGHT & CO., LTD., London, W.C., chemical manufacturers. (M., 21/3/36.) Registered March 6, £500 debenture, to H. G. de Laszlo, Old Bowry House, Wraysbury; general charge.

LIPTON'S SPRAY PRODUCTS, LTD., London, W.C., chemical manufacturers. (M., 21/3/36.) Registered March 6, £250 debenture, to T. B. R. Wilson, 63 High Street, Newport (Mon.); general charge.

NEWTON AND WRIGHT, LTD., London, W., manufacturers of scientific instruments, etc. (M., 21/3/36.) Registered March 6, £1,800 mortgage, to Friends' Provident and Century Life Office; charged on an agreement for sale and purchase of land and factory in Ballards Lane, Finchley. *£25,800. Nov. 11, 1935.

IRISH OIL AND CAKE MILLS, LTD., Drogheda. (M., 21/3/36.) Registered March 4, £40,000 mortgage and charge, to Friends' Provident and Century Life Office, London; charged on leasehold premises, etc., at Drogheda, and all plant, machinery, equipment and fixtures in and about said premises, also general charge. *Nil. January 13, 1936.

County Court Judgments

(NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court Judgments against him.)

BARNES, THOS. DURREL, 49 Queen Victoria Street, E.C., chemical merchant. (C.C., 21/3/36.) £25 10s. 2d. January 20.

HYDE (E. H.) & CO., LTD., 93 Terminal House, Grosvenor Gardens, S.W., dyers and cleaners. (C.C., 21/3/36.) £46 4s. 2d. February 11.

SYKES, T. (male), 40 Cedar Road, Fenham, chemist. (C.C., 21/3/36.) £10 3s. 2d. February 14.

Forthcoming Events

BIRMINGHAM

Mar. 26.—Institute of Brewing. Midland Counties Section. "Brewery Practice and Equipment in the United States in the Post-Prohibition Period." Mr. Aage Gusmer. Queen's Hotel, Birmingham. 6.30 p.m.

BURTON-ON-TRENT

Mar. 25.—Institute of Brewing. Burton-on-Trent Section. "The Research Work of the Institute." Professor R. H. Hopkins. Queen's Hotel, Burton-on-Trent.

DERBY

Mar. 27.—British Association of Chemists (Notts. and Derby section). Annual section meeting. The Irongates, Derby. 7.15 p.m.

MANCHESTER

Mar. 27.—Institute of Fuel (North-Western Section). Meeting by invitation of Manchester Association of Engineers. "Modern Gasworks Practice." Dr. E. W. Smith. 7.15 p.m.

Mar. 27.—Manchester Literary and Philosophical Society, Chemical Section. "Co-operation between Chemistry and Medicine." Dr. A. Renshaw. 7 p.m.

NEWCASTLE-ON-TYNE

Mar. 24.—Institute of Chemistry. Newcastle Section. Joint meeting with the Society of Chemical Industry. "Micro-chemical Analysis." Dr. P. L. Robinson and Dr. L. A. Sayce.

Company News

Waxed Papers.—The payment of a final dividend on the 7½ per cent. cumulative preference shares is announced for the year to June 30, 1930.

Waxed-Papers.—The net profit for 1935 is £17,052, against £4,646; to reserve is placed £1,000; preference dividend for the year ended June 30, 1930, at 7½ per cent., less tax, accounts for £9,375, and £12,445 (£5,768) is carried forward.

Midland Tar Distillers.—The dividend of 2½ per cent. in respect of the year ending June 30, 1936, mentioned in THE CHEMICAL AGE last week should have been referred to as an interim dividend. It was not, as the announcement rather suggested, a final dividend.

Pinchin, Johnson and Co.—A further substantial recovery in profits for 1935 is shown in a preliminary statement. Profits, after all charges, depreciation, etc., have risen by £41,000, to £358,131. The total ordinary dividend is raised 2½ per cent., to 20 per cent., with a final payment of 12½ per cent. This is payable on larger capital, as in April last 300,000 4 per cent. cumulative preference £1 shares at par and 75,000 ordinary 10s. shares were issued at 28s. per share to shareholders and staff.

British Aluminium Co.—According to a preliminary profit statement for 1935, after providing for tax, debenture interest and £50,000 for depreciation (the same as in 1934) the amount earned for dividend is over £76,600 higher at £246,852. The 1933 net figure was £110,851. The dividend on the £2,000,000 ordinary share capital is maintained at 7½ per cent. This takes a gross amount of £150,000 this year, against £97,804 in the previous year, the 998,966 shares issued in June, 1934, not ranking for a full year's dividend. Preference share dividend also takes more, owing to the issue of 500,000 shares in 1934. The carry-forward is up from £55,375 to £62,227.

New Companies Registered

Abbey Engineering, Ltd., 2 Bond Court, Walbrook, E.C.4.—Registered February 5. Nominal capital £2,000. Manufacturers of and dealers in appliances, apparatus, plant and machinery for ventilating purposes or for conditioning, re-conditioning, compressing, cleaning or treating air, gases, or chemical products; electrical, hydraulic, civil, mechanical and general engineers, etc. A subscriber: J. Bennett.

Brettenham Chemical Co., Ltd., Russell Chambers, Covent Garden, London, W.C.1.—Registered February 29. Nominal capital £1,000. Vendors, importers, exporters and/or manufacturers of and dealers in drugs, chemicals, medicines, salts, acids, serum, alkalis, etc.

Chemical and Natural Products, Ltd.—Registered February 24. Nominal capital £10,000. Manufacturers of and dealers in all kinds of medicines, drugs, remedies, preparations, etc. A subscriber: Ormond J. Hook, "Dorana," Grange Crescent, Chigwell, Essex.

W. Davison and Co., Ltd., The Old House, Potters Heath, Welwyn, Herts.—Registered March 5. Nominal capital £1,000. Chemical and scientific research, etc. Directors: Wm. Davison, Mrs. Anna P Davison.

Fraser Colour Products, Ltd., Cheyne House, 62-3 Cheapside, London, E.C.—Registered February 22. Nominal capital £10,000. To acquire the business of manufacturers and sellers of coloured creosotes, paints and damp proof and fireproof solutions, etc., carried on by T. Fraser King and R. G. Hinton, at Hyde Vale, Royal Hill, Greenwich, S.E., and to carry on the business of lead and zinc manufacturers, etc. Directors: George W. Chisholm, Harold H. Trafford, Thomas Fraser-King, Walter A. L. Greening.

Graham and Primrose, Ltd., 116 Hope Street, Glasgow.—Registered February 28. Nominal capital £20,000. Wholesale and retail chemists and druggists, etc. Directors: William Pender, Ian M. Grant.

L. Light and Co., Ltd., 6 Featherstone Buildings, High Holborn, W.C.1.—Registered February 19. Nominal capital £1,000. To acquire the business of a chemist and fine chemical manufacturer carried on by Louis Light. Directors: Louis Light, Dr. Harry J. F. Weiss, Henry G. de Laszlo.

Lyon and Lyon, Ltd.—Registered February 19. Nominal capital £220,000. To acquire the business formerly carried on by Stainsby and Lyon, Ltd., and to carry on the business of manufacturers, storers and transporters of and dealers in chemicals and chemical products of all kinds, petroleum, petrol, benzole, naphtha and other mineral, vegetable and animal oils, coal, coke, tar and its products, mine owners, etc. Directors: Harry L. Lyon, Hillam Hall, Monk Fryston, Yorks, Chas. G. Lyon, Major Wm. E. Lyon, Victor B. J. Seely, Jocelin B. Sumner.

A. R. Valentine, Ltd.—Registered February 19. Nominal capital £300. Manufacturing, pharmaceutical, analytical and dispensing chemists and druggists' sundriesmen, etc. Directors: Herbert E. Fisk, Dell Wood, Beel Lane, Amersham Common, Bucks; Archibald R. Valentine.

APPOINTMENTS VACANT

(2d. per word; minimum 18 words; 3 or more insertions, 1½d. per word per insertion. Sixpence extra is charged when replies are addressed to box Numbers.)

COMPETENT Shorthand Typist required by Firm of Chartered Patent Agents; one with knowledge of chemical terms and phraseology preferred. Write full particulars in confidence Box 274, Sells, Ltd., 14 Lancaster Place, Strand, W.C.2.

EDUCATIONAL

(2d. per word; minimum 18 words; 3 or more insertions, 1½d. per word per insertion. Sixpence extra is charged when replies are addressed to box Numbers.)

SALTERS' INSTITUTE OF INDUSTRIAL CHEMISTRY

GRANTS-IN-AID.

The Committee will in July allocate a limited number of Grants-in-Aid to young men and women employed in chemical works in, or near, London, who desire to extend their education for a career in chemical industry. Applicants must not be under 17 years of age. Applications with particulars of age, nature of employment and the manner in which the grant would be used, and giving the name of some person to whom reference may be made, should be sent as soon as possible and in any case not later than May 1st, 1936, to the Director of the Institute, Salters' Hall, St. Swithin's Lane, London, E.C.4.

ARTHUR SMITHELLS,
Director.

SALTERS' INSTITUTE OF INDUSTRIAL CHEMISTRY

FELLOWSHIPS.

Applications are invited for a limited number of Fellowships available for chemists of post-graduate standing. The object of the Fellowships is to afford additional and special training at home or abroad preparatory to a career in industrial chemistry. The course to be followed will in each case be decided by the Director in consultation with the Fellow. The value of a Fellowship is normally from £250 to £300, but the Institute is prepared to consider applications which might justify the award of Fellowships of higher value.

Applications should be received by the Director of the Institute, Salters' Hall, St. Swithin's Lane, London, E.C.4, on or before

1st MAY, 1936.

Further particulars and forms of application may be had on request.

ARTHUR SMITHELLS,
Director.

FOR SALE

(2d. per word; minimum 18 words; 3 or more insertions, 1½d. per word per insertion. Sixpence extra is charged when replies are addressed to box Numbers.)

'Phone 98 Staines.

BONECOURT Gas Fired Boiler 66 in. by 33 in.; Werner Jacktd. Mixer 29 in. by 29 in. by 23 in.; Werner "Z" Blade Ditto 20 in. by 20 in.; 60 gal. Copper Vacuum Pan; Triple Granite Refiner 24 in. by 12 in.; 30 in. Tullis Hydro.
HARRY H. GARDAM AND CO., LIMITED, STAINES.

CHARCOAL, ANIMAL and VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal, insulating; also lumps ground and granulated; established 1830; contractors to H.M. Government.—THOS. HILL-JONES, LTD., "Invicta" Mills, Bow Common Lane, London, E. Telegrams: "Hill-Jones, Bochurch, London." Telephone: 3633 East.

COPPER STEAM JACKETTED MIXING PAN, 72 ins. dia. by 60 ins. deep, domed cover, stirring gear. THOMPSON AND SON, 60 Hatcham Road, Canterbury Road, London, S.E.15. New Cross 1147.

MIXING MACHINE by Joseph Baker, pan 4 ft. × 4 ft. × 3 ft. deep, hand and power tipping, reversible blades, belt driven, with friction clutch. C. F. DAVIS, LTD., 60 Hatcham Road, Canterbury Road, Old Kent Road, London, S.E.15. New Cross 1147.

TENDERS

(2d. per word; minimum 18 words; 3 or more insertions, 1½d. per word per insertion. Sixpence extra is charged when replies are addressed to box Numbers.)

BOROUGH OF ACTON.

THE Town Council invites tenders for the installation of a Continuous Drying Machine in the Laundry at the Public Baths. A Specification and Form of Tender may be obtained on application to Mr. W. G. Cross, M.Inst., C.E., Borough Engineer. No tender will be received except in a sealed envelope endorsed "Drying Machine—Public Baths" and delivered to the undersigned not later than 3 p.m., Monday, 6th April, 1936. The Council does not bind itself to accept the lowest or any tender, and canvassing members of the Council either directly or indirectly will be a disqualification.

H. C. LOCKYER,
Town Clerk.

Municipal Offices,
Acton, W.3.
13 March, 1936.